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WATER SYSTEMS MANAGEMENT USERS GUIDE

Engineering and Research Center
Water and Power Resources Service

April 1980

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16. ABSTRACT

Total Irrigation Management Services (TIMS) is a multiapplications program that can be applied by the user to improve water management. The program can provide the irrigator and district assistance using various levels of irrigation scheduling and systems scheduling. The levels vary with the intensity of the service provided, but all delegate to the irrigator and the district the final decisions of water applications and deliveries. The levels of irrigation scheduling consist of the intense field irrigation scheduling and the less intense irrigation guide. System scheduling is provided at the intense lateral scheduling level and the less intense delivery requirements level. Any of these levels or intensities can be tailored to meet the need of the irrigators or districts.

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WATER SYSTEMS MANAGEMENT USERS GUIDE

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April 1980

Water O&M Branch
Division of O&M Technical Services and
Division of Research
Engineering and Research Center
Denver, Colorado

UNITED STATES DEPARTMENT OF THE INTERIOR ★ WATER AND POWER RESOURCES SERVICE

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On November 6, 1979, the Bureau of Reclamation was renamed the Water and Power Resources Service in the U.S. Department of the Interior. The new name more closely identifies the agency with its principal functions — supplying water and power.

The text of this publication was prepared prior to adoption of the new name; all references to the Bureau of Reclamation or any derivative thereof are to be considered synonymous with the Water and Power Resources Service.

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INTRODUCTION

Continuing development of irrigation projects as well as improved irrigation methods, such as sprinkler and drip irrigation, has brought land under irrigation which previously was considered unsuitable for irrigation. In some cases this has resulted in the allocation of all available water for irrigation. This extensive use of water for irrigation, the increasing demand imposed by municipal and industrial development, and the increased attention being given to water conservation, has made efficient use of available water a necessity. But efficient use of water implies efficient storage; efficient distribution of water through a series of canals, laterals, and farm ditches; and efficient application of that water to the field.

A computer-supported program can provide the tools and concepts for improving project operations for effective utilization of irrigation water. This program integrates the onfarm water management with the operations of the distribution system to achieve total water management at the irrigation project level. The value of irrigation scheduling, when to irrigate, and how much water to apply, has long been recognized as a means for conserving water and improving onfarm water management. With the expansion of this onfarm water management into the distribution system, the results are increased net returns to the irrigator through: greater yields and improved crop quality with corresponding lower production costs, reduced irrigation project operation and maintenance requirements, improved criteria for irrigation planning and development, and more favorable environmental impact of the water resource development for irrigation.

In 1970, the Bureau first applied a computer supported irrigation management program. Since then changes in method of application has resulted in a variety of computer programs. Through development, testing, and application, the computer programs have been modified to provide a simple and accurate support tool. This User's Manual presents one computer program that is simple to operate and can be used on the smaller minicomputers; yet offers the user a tool to provide improved water management information.

SCHEDULING PRINCIPLES

To provide improved water management at the project level, TIMS provides a means of scheduling water deliveries throughout the distribution system. This concept, referred to as system scheduling, is supported by onfarm irrigation scheduling. To apply TIMS to an irrigated area or project, the reader should have an understanding of the basic principles involved in irrigation scheduling. In this section some of the basic principles used in the computer program are discussed. This section is not intended to give the reader a complete review and understanding of soil-water-plant relationships. To fully apply TIMS in an irrigation project the user should also have a full understanding of the operations of that project.

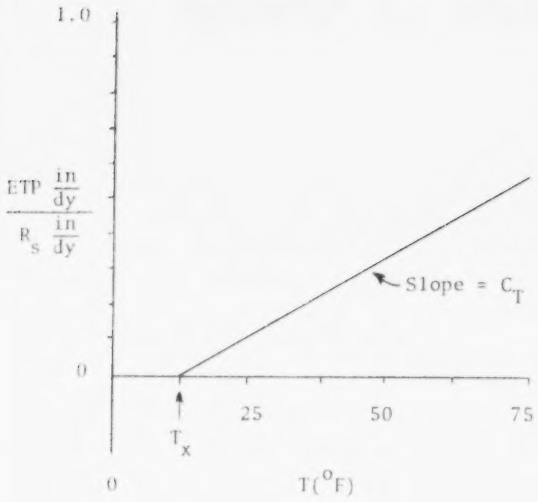
Evapotranspiration Potential

Various procedures are available for determining the evapotranspiration rate (consumptive use) of a specific crop. The procedure used in TIMS is an adaptation of a procedure developed by the Science and Education Administration (formerly the Agricultural Research Service), United States Department of Agriculture.

The evapotranspiration rate for a reference crop, such as healthy alfalfa with 10 to 12 inches top growth, is first determined. Alfalfa is used because it is grown in nearly every irrigated area. This reference evapotranspiration rate is called the ETP (potential evapotranspiration) rate. Mathematically, the ETP is determined using the Jensen-Haise equation,

$$ETP = C_T (T - T_x) R_s$$

Where ETP is inches of evapotranspiration potential of a reference crop, C_T may be thought of as the reciprocal of the average monthly temperature for the warmest month, T is the daily average temperature in °F, T_x is a graphic intercept as shown below, and the R_s is total solar radiation in inches of water equivalent per day. Jensen's model was obtained by plotting $\frac{ETP}{R_s}$ vs. T; thus:



When accurate evapotranspiration data are available for an area, the values of C_T and T_x can be calibrated. Where evapotranspiration data are not available, these values can be computed as follows for rough crops:

$$C_T = \frac{1}{(68 - 3.6\,E/1000) + 13C_H}\ ,\ (T\ in\ °F)$$

$$C_T = \frac{1}{(38 - 3.6\,E/1000) + 7.3C_H}\ ,\ (T\ in\ °C)$$

[where C_H, a humidity index, is]

$$C_H = \frac{37.5\ \text{mm}\ H_g}{e_2 - e_1}\ \text{or}\ \frac{50\ mb}{e_2 - e_1}$$

e_2 is the saturation vapor pressure at mean maximum air temperature for the warmest month.

e_1 is the saturation vapor pressure at mean minimum air temperature for the warmest month.

$$T_x = 27.5 - 0.25(e_2 - e_1) - \frac{E}{1000}\ ,\ (T\ in\ °F)$$

$$T_x = 27.5 - 0.33(e_2 - e_1) - \frac{E}{1000}\ ,\ (T\ in\ °F)$$

where E = elevation in feet.

Care must be exercised in selecting correct values of C_T and T_x. Experience has indicated that elevation adjustments above 2,000 feet result in high ETP values that are not representative.

Evapotranspiration

The evapotranspiration (ET) rate of a specific crop is determined by adjusting the ETP by a crop coefficient.

$$ET = K_c \times ETP$$

Changes in climatic conditions from growing season to growing season have a significant effect on plant development. A procedure has been developed to relate the stage of growth, not to a fixed increment of time, but to an increment of energy input related to crop development. The measurement of energy input used is the ETP. An increment of ETP reflects the climate changes and the corresponding changes in growth stage intervals independent of time.

The procedure is based on the correlation of recorded ETP to developed crop coefficients, figure 1.

From a known season of record, the summation ETP and growth stage keypoints are noted for the complete growing cycle of a crop. The keypoints refer to planting, emergence, beginning

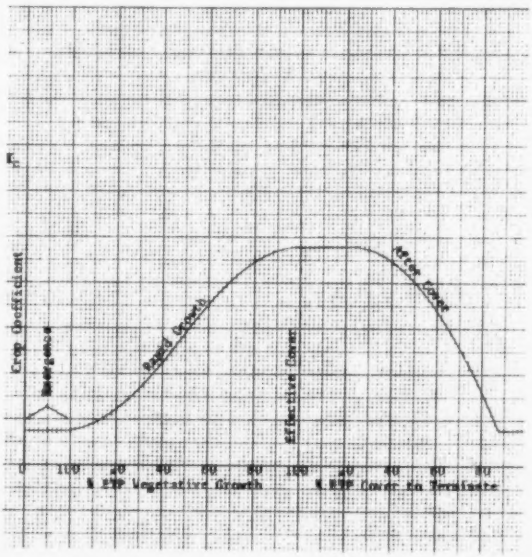


Figure 1.-Generalized crop coefficient curve

of rapid vegetative growth, effective cover, and terminations. The summation of ETP is computed using the described Jensen-Haise procedure. Close observations to pinpoint the growth stage keypoints and calibration of climatic parameters used are necessary.

The crop coefficient for alfalfa increases from the beginning of rapid vegetative growth in the spring to approximate first cutting. Following the first cutting, a constant K_c value is used. This eliminates the need for accommodated cuttings on individual fields.

ET vs. ETP

A further extension of the crop coefficient has been developed by directly relating the ET of a crop to the ETP accumulated during the crop growing period. This simplifies the relationship $ET = K_c \times ETP$ for both historic crop consumption and forecasting purposes. This relationship can be illustrated as shown in figure 2.

As seen in Figure 2, for any accumulated value of ETP (A), the corresponding accumulated value of ET (C) since planting can be determined. Likewise for any subsequent value of ETP (A^1), the corresponding value of ET (C^1) is known. The slope of the curve represents the mean crop coefficient for a particular interval of ETP by the relationship:

$$\bar{K}_c = \frac{ET}{ETP}$$

The user can easily develop the relationship of ET vs. ETP for the various crops to be scheduled. As the summation of ETP to the various growth stage keypoints are developed, the ET vs. ETP relationship can be determined, for a known recorded period.

A similar relationship can be developed between the accumulated ETP and time, figure 3.

For any number of days since the beginning of recorded climate data, the accumulated ETP can be determined. Likewise any incremental change in accumulated ETP can be related to the appropriate number of days. By using Figures 2 and 3 in combination, the change of ET can be

Table 1.-Crop coefficients for typical irrigated crops

Crop	Pre-vegetative growth	Rapid vegetative growth, percent ETP									
		10	20	30	40	50	60	70	80	90	100
Corn	0.15	0.17	0.23	0.32	0.44	0.57	0.70	0.81	0.90	0.95	0.95
Sugar Beets	.15	.17	.22	.31	.42	.54	.66	.76	.84	.89	.89
Small Grains	.15	.17	.24	.34	.46	.60	.74	.86	.95	1.01	1.01
Pasture	.15	.17	.22	.30	.41	.52	.63	.73	.81	0.85	0.85
Beans	.15	.17	.23	.32	.44	.57	.70	.81	.90	.95	.95
Potatoes	.15	.17	.23	.32	.43	.56	.68	.79	.88	.93	.93
Alfalfa	.25	.31	.37	.43	.49	.55	.61	.67	.73	.79	.85

Crop	Cover to termination, percent ETP									
	10	20	30	40	50	60	70	80	90	100
Corn	0.96	0.96	0.96	0.96	0.95	0.91	0.84	0.77	0.67	0.56
Sugar Beets	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
Small Grains	1.02	1.02	1.02	1.02	1.00	.96	.92	.86	.80	.73
Pasture	0.86	0.86	0.86	0.86	0.86	.86	.86	.86	.86	.86
Beans	.95	.95	.95	.89	.80	.67	.51	.32	.15	.15
Potatoes	.92	.92	.94	.94	.94	.93	.89	.81	.70	.53
Alfalfa	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85

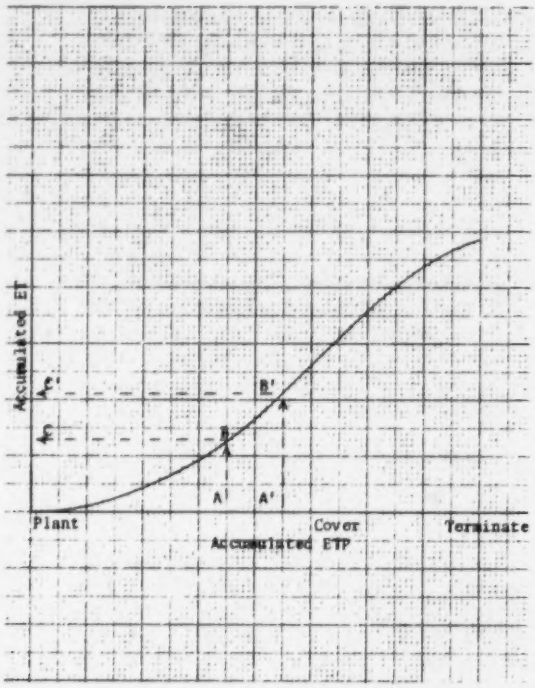


Figure 2. -Generalized relationship of ET vs. ETP.

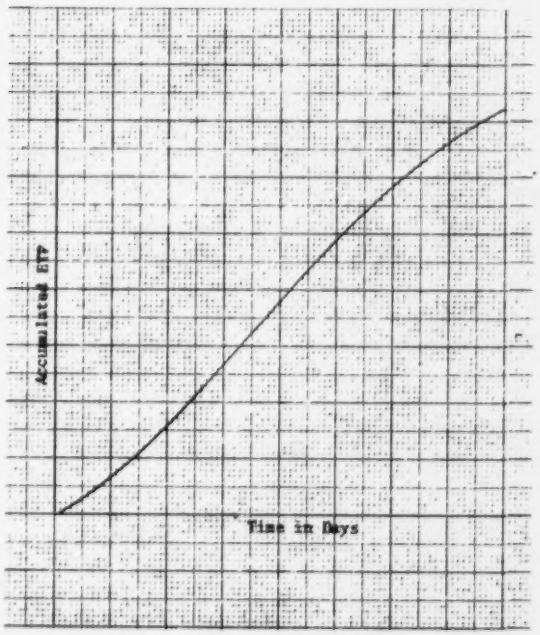


Figure 3.-Generalized relationship of ETP vs. Days.

related directly to a change in time and vice versa.

Soil Moisture Depletion

For the purpose of scheduling irrigations, a daily water budget analysis is made for each field. Data used are the daily evapotranspiration rate, effective irrigation amounts, and precipitation. The water budget computes the daily soil moisture depletion (SMD) by adding the previous depletion and daily ET and subtracting irrigation and precipitation amounts. The daily depletion obtained is the amount of water required to refill the soil profile on that day. By projecting the ET rate into the future, the date can be pinpointed when the SMD will reach an optimum level. This optimum level of SMD is referred to in TIMS as the allowable depletion (ALLOW).

When scheduling irrigations using TIMS, ALLOW is set by the user. This is optimum level of SMD to be reached at the next irrigation event. By setting the ALLOW, the user has flexibility in scheduling each individual field. Under less intense levels of scheduling, the allowable depletion is estimated mathematically using the following equation,

$$ALLOW = (.33 + G2) + (G2 + (JO - JP)/60),$$

where G2 is the product of the crop factor and soil water holding capacity, JO is the Julian date of the latest water order, and JP is the Julian date of planting.

ALLOW will increase from a minimum at planting of .33 G2 to a maximum of G2. The crop factor is a product of the maximum crop root zone and optimum percent depletion. Table 2 summarizes the crop factors for typical irrigated crops.

Table 2.-Crop factors for typical crops[1]

Crop	Factor
Corn	1.5
Sugar Beets	1.5
Small Grains	1.5-2.1
Pasture	1.2
Beans	1.3
Potatoes	0.8
Alfalfa	2.4

[1] Unpublished Data

Water-holding capacity is a measure of the amount of water held at field capacity (maximum water retained against gravity) less the amount of water retained in the soil at the permanent wilting percentage, both on a volumetric basis. Good measurements of field capacity and permanent wilting percentage are required as the basis for defining the amount of water available from the soil for plant growth. Water holding capacity of the various soils on a project should be determined locally. Table 3 is a listing of water-holding capacities that can be used as a general guide.

Table 3.-Approximate available water holding capacities for various textural classes (unpublished data)

Textural class	Water holding capacity, (in/ft)
Coarse sand and gravel	0.24 - 0.72
Sands	0.48 - 1.08
Loamy sands	0.72 - 1.44
Sandy loams	1.32 - 1.80
Fine sandy loams	1.68 - 2.16
Loams and silt loams	2.04 - 2.76
Clay loams and silty clay loams	1.68 - 2.52
Silty clays and clays	1.56 - 2.16

Reference Fields

Regardless of the level of intensity provided by computerized irrigation scheduling, the close monitoring of crop parameters is essential to maintaining a quality and reliable service. This monitoring of crop parameters is needed in more detail than that provided through routine checking of scheduled fields. Parameters such as crop growth stage, allowable soil moisture depletion, moisture extraction pattern, and water use rate need to be measured. This is accomplished through a concept referred to as reference fields. The reference field concept signifies fields representative of the major crops grown in an irrigated area. The field checking of an individually scheduled field determines the soil moisture depletion level as a starting point for forecasting purposes. The use of detailed data from a limited number of reference fields refines the theoretical forecasting process to reflect localized conditions. Collected data are used as input for making necessary adjustments in the computerized budget process. Necessary adjustments are made to growth stage estimates, crop coefficients, or computed evapotranspiration to reflect reference field findings. Reference field data are used for quality control of field-by-field irrigation schedules. Soil moisture depletion data collected from reference fields are used to establish allowable depletion levels for irrigation guide purposes. Reference fields are selected to be representative of the major crops grown in an area, or water district, but are also better than average crop and field conditions. In addition to being a source of crop parameters, these fields are used as classrooms for training and maintaining of field personnel techniques. Field personnel can compare the reference fields with individual scheduled fields.

APPLICATION

Turnout Schedules

Field irrigation scheduling provides the irrigator or farm manager with the daily soil moisture status of each of his fields. Not all fields on a farm are scheduled as a unit; only those fields served by a single farm delivery point or turnout. The results of the field irrigations scheduling is provided the irrigator on a "Turnout Schedule". This schedule gives the irrigator the optimum date and amount of the next irrigation. Irrigation applications are indicated by the required flow and duration adjusted for efficiencies to meet the soil moisture depletion at the forecasted date. Turnout schedules are provided the irrigator on a regular interval of once or twice weekly. Along with daily climatic data used to compute the ET of each crop, field data such as the latest irrigation information and current soil moisture status are collected by a trained field technician. Other information included are the effective root zone and water-holding capacity for that root zone, along with the recommended allowable depletion.

Fields that are included on the turnout schedule, but not visited or served by a field technician, are referred to as nonscheduled fields. Each nonscheduled field is identified by the crop type, approximate planting data, acreage, and turnout capacity. Reference field data are used as a guide for crop/field parameters. Confirmed water orders received by the irrigation district

are used in place of past irrigation data. Future irrigation events, forecasted as water orders for nonscheduled fields are only estimates and are not as reliable as forecasts to scheduled fields that are routinely visited by a technician.

Lateral Schedules

The scheduling of irrigation to individual fields are expanded throughout the distribution system. System scheduling procedures accommodate all water orders and forecasted events to develop lateral schedules whether or not all irrigators participate in the irrigation scheduling service. Confirmed water orders in conjunction with the forecasted schedule for each turnout on a lateral are combined to form the lateral schedule. This schedule is used by the operating personnel of the district as a record of existing water deliveries, confirmed water orders, and forecast turnout schedules. The forecasting of turnout schedules are only an indication of future deliveries until water orders are received by the irrigation district and confirmed. However, the lateral schedule can indicate, for the district, any possible conflicts of delivery problems such as exceeding capacity of the system or a sharp increase or decrease in flow.

Farm Irrigation Guide

The farm irrigation guide can be provided as a supplemental service along with the field irrigation scheduling service provided. The guide provides general irrigation scheduling information based on daily ET rates and allowable depletions for major crops grown in an area. Reference field data are used to develop the allowable depletion information and any needed adjustments to ET rates.

Irrigation District Delivery Schedule

This schedule provides the district with a tabulation of past, present, and future demands based on the current cropping patterns and climate. For all or a portion of the district, the crop consumptive use to date, irrigation requirement to date, and forecast delivery requirement can be determined. The irrigation and delivery requirements are adjusted for effective precipitation and system efficiency. This schedule can be useful to the operating personnel of the district in the operation of the distribution and storage facilities.

PROGRAM DESCRIPTION

This computer program, consisting of 14 separate BASIC language routines, incorporates most of the theories used in past programs, such as IMS75 and MINI versions for field scheduling. The program also includes system scheduling and delivery requirements as integral components. The program uses climate data, crop consumptive use data, distribution system data, ditchrider data, field cropping patterns, and area-wide cropping patterns to develop up to five different reports. Except for some initial setup requirements and occasional editing of data files, the program can be used as a single means to achieve many IMS objectives.

Seven input data files are required as listed below:

A. Climate
B. Crop Consumptive Use
C. Lateral-Field
D. Area
E. Fieldman's Scheduling Sheets Select
F. District Delivery Schedules Select
G. Farm Irrigation Guide Select

Additional sections of this manual will describe how to operate the program TIMS, using an example run, and the input and output reports generated.

Appendix B of this manual contains a listing of each of the 14 separate BASIC language routines which make up the TIMS program. Each listing contains comments, preceded by dollar signs ($) or asterisks (*), to assist the reader in understanding the BASIC language code. Executable versions, which contain no comments, are available upon request. The documentation in this manual is for the TIMS program on a Datapoint model 1132 minicomputer with 16,000 8-bit words[1]. Should a minicomputer or computer with larger memory capacity be used, these 14 routines could be merged together to form a more condensed package.

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[1]A Datapoint model 1132 minicomputer was used for the development of the program logic. The company name is included for the benefit of the reader and does not imply any endorsement or preferential treatment by the U.S. Department of the Interior.

Flow Diagram

The TIMS program flow diagram shows the program and data flow throughout the 14 routines, figure 4. Notice the use of intermediate files (INTER, INTER1, and INTER2) which allow for temporary data storage or passage of calculated data from one routine to another. Operation of the program involves nine steps, each of which is noted on the flow diagram and explained in detail in "How to Run the Program".

Explanation of BASIC Language Routines

Fourteen individual BASIC language routines comprise the TIMS program on the Datapoint model 1132 minicomputer. With larger memory, these could be merged together. Following are descriptions of the routines and the data files used in each.

A. PETP

PETP reads the climate data file (CLDATA), and for all new climate days calculates the Jensen ETP, sum ETP to date, and daily effective rain. The data are printed on the CRT as they are calculated. After the last new day, the routine prompts the user for the forecast ETP values. Intermediate file (INTER) is used to contain all data until calculations are completed and then is copied back onto the climate file.

B. PFMS

PFMS prepares the input data required by routine PFMS1 which generates the fieldman's scheduling sheets. The climate data file (CLDATA), crop consumptive use file (CROPCU), and select fieldman's scheduling sheet file (SELFSS) are used.

C. PFMS1

PFMS1 performs the calculations for the fieldman's scheduling sheets. Selected crops are read from the select file and, for each crop, a fieldman's scheduling sheet is produced on the PRINTER.

D. PFLD

PFLD provides an interactive method for updating the lateral-field file (LATFLD). Intermediate files are produced each time the user cycles through one of the codes noted below. These intermediate files are called LATFLDn, where n is 1-9.

Code	Function
1	Water orders
2	Change field data
3	Add field data
4	Stop

This routine prompts the user for the lateral-field data. Within codes 2 and 3 the user must enter data by item number. Below is a list of the item numbers and corresponding data:

Item	Data
1	Acres
2	Crop number
3	Plant date
4	Summation of ETP at plant date
5	Irrigation efficiency
6	Allowable depletion
7	Holding capacity
8	Water order date
9	Order cubic feet per second
10	Order hours
11	Start date
12	Next date

E. PCAL

PCAL prepares the input data from both the climate (CLDATA) and crop consumptive use (CROPCU) files for use in routine PCAL1, which calculates the dates and amounts of the next irrigation events on each field.

F. PCAL1

PCAL1 uses climate and crop consumptive use data to produce dates and amounts of next irrigation events for each field on the lateral-field file (LATFLD). The calculated data are placed onto the intermediate file (INTER) which is then used in routine PCAL2.

G. PCAL2

PCAL2 uses the intermediate file (INTER), which was produced in routine PCAL1, and crop consumptive use data to calculate required data for turnout and lateral scheduling. The lateral-field file (LATFLD) is used. The

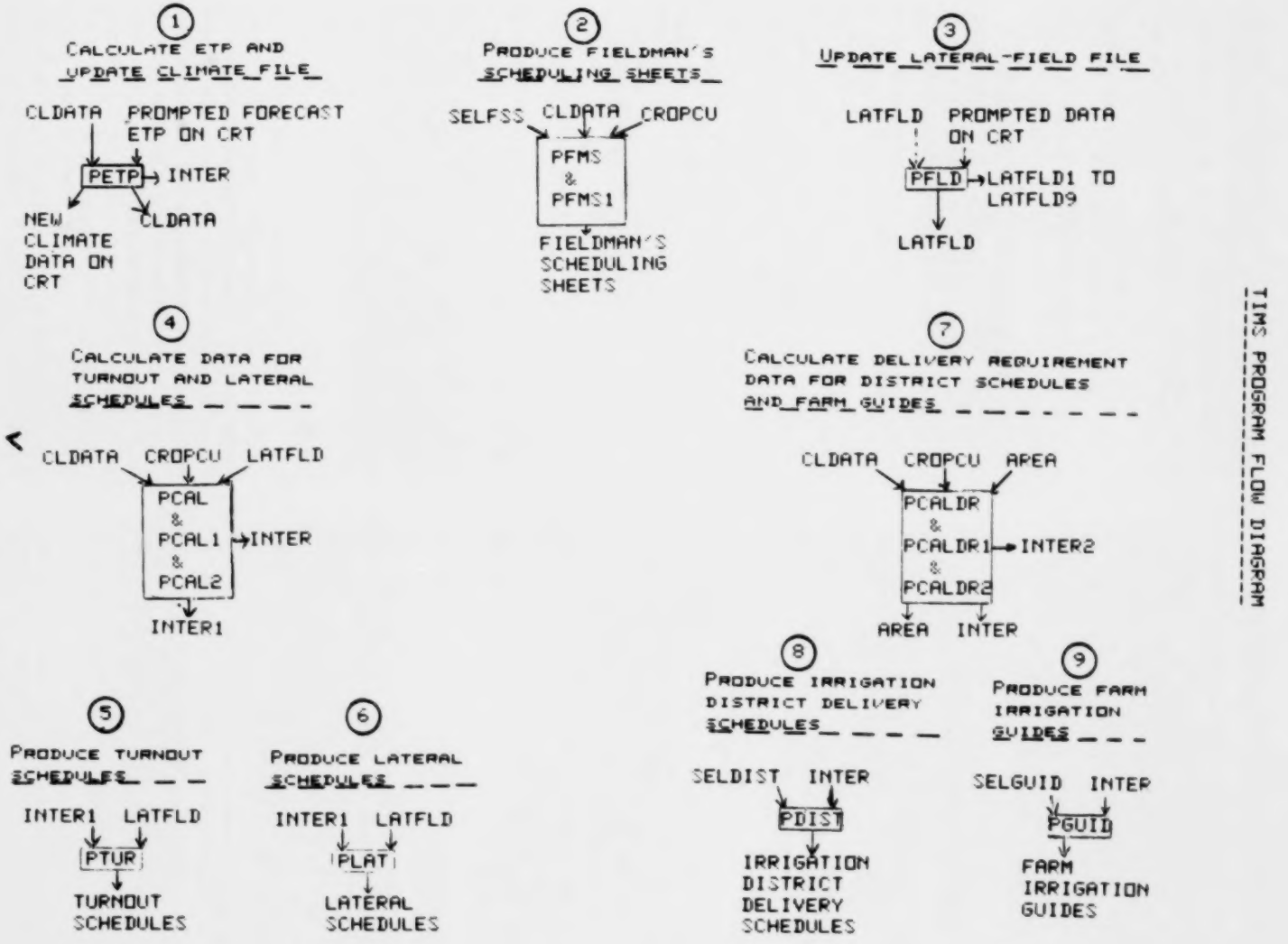

Figure 4.-TIMS program flow diagram

calculated data are placed onto a new intermediate file (INTER1). As each turnout is processed, the lateral and turnout names are printed on the CRT.

H. PTUR

PTUR uses data from the new intermediate file (INTER1), produced in routine PCAL2, and data from the lateral-field file (LATFLD) to generate turnout schedules. These turnout schedules are produced on the PRINTER.

I. PLAT

PLAT uses data from the new intermediate file (INTER1), produced in routine PCAL2, and data from the lateral-field file (LATFLD) to generate lateral schedules. These lateral schedules are produced on the PRINTER.

J. PCALDR

PCALDR prepares data from the climate (CLDATA) and crop consumptive use (CROPCU) files for use in routine PCALDR1, which calculates delivery requirements. The area file (AREA) and new temporary area file (INTER2) are also prepared here.

K. PCALDR1

PCALDR1 generates a new temporary area file (INTER2) by calculating the irrigation requirements for the update period. The irrigation requirement sum-to-date is read from the area file (AREA). An intermediate file (INTER) is also produced, which contains data required for the district (PDIST) and guide (PGUID) routines. Routine PCALDR2 will copy the new temporary area file back to the area file. As each crop is processed, the area, system, and crop names are printed on the Cathode Ray Tube (CRT).

L. PCALDR2

PCALDR2 copies the new temporary area file (INTER2) produced in routine PCALDR1 back to the area file (AREA).

M. PDIST

PDIST uses the data located on the intermediate file (INTER), which was produced in routine PCALDR1, and the select district file (SELDIST) to generate irrigation district delivery schedules. These schedules are produced on the PRINTER.

N. PGUID

PGUID uses the data located on the intermediate file (INTER), which was produced in routine PCALDR1, and the select guide file (SELGUID) to generate irrigation guides. These guides are produced on the PRINTER.

HOW TO RUN THE PROGRAM

The following procedure shows how a typical update run can be made. The procedure used is the Datapoint CHAIN command. Other methods could be used, if desired, but the CHAIN procedure replaces the typing of numerous commands normally required at the keyboard. Appendix A contains a list of the CHAIN file. Initial input files must be built by the user prior to running the program. The building of files is discussed in the section entitled "Initial Data Organization." For operation on a Datapoint minicomputer having two diskette drives, the data diskette is placed in drive 0 and the program diskette in drive 1.

To operate the program, the user need only type one command which contains up to eight different tag names. The tag names are descriptions of what the user wants the computer to do. Each tag name calls the appropriate calculating routine or performs a specific function. Following is a list of the tag names and related activity.

Tag name	Function
CLIMATE	Makes a backup copy of the climate file, enters DATAFORM for climate data entry (adds data to end of climate file), and calls the ETP routine which prompts user for forecast ETP data and updates the climate file.
FSS	Generates the fieldman's scheduling sheets.
DATA	Makes a backup copy of the lateral-field file and allows for the entry of lateral-field data.

TURN	Calculates the turnout schedules, and calls the turnout print routine.
LAT	Calculates the lateral schedules, if not already done by the TURN tag, and calls the lateral print routine.
DIST	Makes a backup copy of the area file and calculates delivery requirement schedule. Included under this tag is the district delivery schedule print routine.
GUID	Makes a backup copy of the area file and calculates the delivery requirement schedule, if not already done by the DIST tag. Also calls the farm irrigation guide printout routine.
LIST	Lists the updated climate, lateral-field, and area files.

The following example will illustrate an update for the days July 11-20. Additional data will be added to the file when the program is run.

Climate data file CLDATA shows old data from January 1 through July 10, figure 5.

Crop consumptive use data file CROPCU shows data for seven crops, figure 6. If existing data must be modified or additional data added, the user *must* use the Datapoint DATAFORM system prior to running the TIMS program. Using the EDITOR will destroy the file because it is over 79 columns wide. Refer to "Initial Data Organization" for a description of the use of DATAFORM, except use the A or M modes in response to Select Data Mode. Note that this is a reduced listing.

The lateral-field data file LATFLD shown on the next page shows the data through the July 10 update, figure 7. Modifications to the data will be made when the program is run.

The area data file AREA listed below shows the data through July 10, figure 8. If existing data must be modified, the user must use the

```
1.1E-2 19.83 164 192 201
101   46  27  34  61     312   0     0       3.8E-2 3.8E-2 1
102   44  19  28  38.7   250   0     0       2.1E-2 5.9E-2 2
103   48  18  30  66.2   250   0     0       2.4E-2 8.3E-2 3
104   50  24  33  86.7   250   0     0       3.1E-2 .114   4
105   52  29  30  64.7   250   0     0       3.8E-2 .152   5
106   47  31  33  35.2   250   .12   0       3.5E-2 .187   6
107   41  26  36  133.7  267   0     0       2.7E-2 .214   7
108   50  20  27  35.8   297   0     0       3.3E-2 .247   8
109   56  20  31  72.5   250   0     0       3.3E-2 .28    9
110   44  26  32  107.6  250   0     7.2E-2  2.8E-2 .308  10
111   44  27  28  130.3  250   0     6E-2    2.9E-2 .337  11
112   45  31  35  180.6  275   0     4.8E-2  3.6E-2 .373  12
113   46  24  32  111.2  275   0     3.6E-2  3E-2   .403  13
114   43  20  29  96.3   250   0     2.4E-2  2.1E-2 .424  14
115   44  23  30  158.6  250   .8    .812    2.5E-2 .449  15
116   48  30  27  64.8   305   0     .72     4.3E-2 .492  16
117   43  32  31  65.8   250   0     .64     3.2E-2 .524  17
118   44  29  33  48     250   0     .56     3E-2   .554  18
119   34  29  30  109    250   0     .48     2.1E-2 .575  19

707   93  45  34  91.3   764   0     1.1E-2  .278  22.994  188
708   91  62  55  82.4   475   2E-2  2.4E-2  .199  23.193  189
709   92  58  59  95.9   550   7E-2  8.8E-2  .224  23.417  190
710   90  66  65  72     475   .23   .309    .204  23.621  191  .3   .3
```

Figure 5.-Climate data file CLDATA before example computer run

```
                        0.00  5.00 10.00 15.00 20.00 25.00 30.00 35.00 40.00 45.00 50.00
ALFALFA     1   0.0 100 0.00  4.30  8.60 12.90 17.20 21.50 25.80 30.10 34.40 38.70  0.00
BARLEY      2   1.2 100 0.00  0.89  3.30  8.47 14.04 17.64  0.00  0.00  0.00  0.00  0.00
TRITI       3   2.0 100 0.00  3.11  8.24 12.94 17.39  0.00  0.00  0.00  0.00  0.00  0.00
SM GRAIN    4   1.2 100 0.00  0.77  3.86  9.05 14.17 16.52  0.00  0.00  0.00  0.00  0.00
MILO        5   1.2 100 0.00   .77  2.04  4.59  8.58 13.00 17.92 22.19 24.37  0.00  0.00
BEANS       6    .7 100 0.00  0.82  2.91  6.61 10.59 13.64 15.08  0.00  0.00  0.00  0.00
NEW ALF     7   0.0  75 0.00  4.30  8.60 12.90 17.20 21.50 25.80 30.10 34.40 38.70  0.00
```

Figure 6.-Crop consumptive use data file CROPCU

```
W-11.7    0.5L              1          0        1.25
  14  38.0  2   401  4.622   75  2.2  0.0  709  1.25 180.0     0     0
  15  38.0  2   327  4.043   75  2.2  0.0  709  1.25 180.0     0     0
  99
W-11.7    0.6R              1          0        1.25
  39  38.0  1   222  1.665   75  3.4  0.0  709  1.25 140.0     0     0
  40  38.0  2   401  4.622   75  2.2  0.0  715  1.25  90.0     0     0
  99
W-11.7    0.8L              5          0        2.60
  45  40.0  3   222  1.665   75  1.0  0.0    0  0.00   0.0     0     0
  60 100.0  3   222  1.665   75  1.0  0.0    0  0.00   0.0     0     0
  61  15.0  1   222  1.665   75  3.0  0.0  712  2.60  24.0     0     0
  99
W-11.7    1.1R              7          0        1.30
  41  17.0  2   410  5.158   75  2.2  0.0  708  1.30 120.0     0     0
  44  25.0  1   222  1.665   75  3.4  0.0  713  1.30  84.0     0     0
  47  36.0  2   105  5.120   75  2.2  0.0  708  1.30 120.0     0     0
  99
W-11.7    1.1L              7          0        1.85
  65  23.0  2   327  4.043   75  0.0  1.8  709  1.85  72.0     0     0
  66  26.0  1   222  1.665   75  3.4  0.0  712  1.85 144.0     0     0
  59  35.0  1   222  1.665   75  3.4  0.0  712  1.85 144.0     0     0
  54  27.0  2   328  4.129   75  0.0  1.8  709  1.85  72.0     0     0
  99
W-11.7    1.2R             14          0        1.35
  94  18.0  1   222  1.665   60  3.4  0.0  706  1.35  48.0   707     0
  95  62.0  4   510  9.519   70  1.7  0.0  708  1.35 108.0   706     0
  99
W-11.7    1.5R             15          0        1.30
   2  36.0  5   510  9.519   70  2.1  0.0  708  1.30 156.0   709     0
   8  38.0  5   510  9.519   70  2.1  0.0  708  1.30 156.0     0     0
  99
W-11.7    1.5L             15          0        1.85
  14  38.0  1   222  1.665   70  3.4  0.0  710  1.80 252.0     0     0
  15  33.0  1   222  1.665   60  3.4  0.0  710  1.80 252.0     0     0
  16  39.0  7   630 21.082   70  2.0  0.0  710  1.85 252.0     0     0
 999
W-11.2W   2.0R             17          0        2.60
   1  84.0  1   222  1.665   50  3.4  0.0  701  2.60 216.0   703     0
   8  30.0  6   614 16.843   50  0.0  2.0  710  2.60  18.0     0     0
   7  41.0  1   222  1.665   50  3.4  0.0  701  2.60 216.0   702     0
  99
W-11.2W   2.0L             26          0        1.25
  21  36.0  3   222  1.665   70  1.0  0.0    0  0.00   0.0     0     0
  26  36.0  2   327  4.043   70  2.2  0.0  705  1.25 125.0   706     0
  99
W-11.2W   2.2L             28          0        1.20
   2  40.0  5   310  9.519   70  0.0  1.8  709  1.20 170.0     0     0
  10  30.0  5   512  9.819   70  0.0  1.8  709  1.20 170.0     0     0
  99
W-11.2W   2.2R              5          0        1.30
  58  38.0  3   222  1.665   70  0.0  0.8    0  0.00   0.0     0     0
  65  40.0  6   614 16.843   70  0.0  2.0  708  1.30  60.0     0     0
 999
```

Figure 7.-Lateral-field file LATFLD before example computer run

```
710
NAPI          BLOCK 1 ALFALFA     4057  1  53   1.665 2.3 75  3.4 17.95 6069
NAPI          BLOCK 1 BARLEY      2002  2  86   4.043 2.3 75  2.2 15.40 2570
NAPI          BLOCK 1 TRITI        599  3  53   1.665 2.3 75  1.0 15.66  802
NAPI          BLOCK 1 SM GRAIN     294  4 130   9.519 2.3 75  1.7 11.04  272
NAPI          BLOCK 1 MILO         504  5 130   9.519 2.3 75  2.1  4.95  212
NAPI          BLOCK 1 BEANS       1261  6 165  16.843 2.3 75 1.4  2.21  234
999
NAPI          BLOCK 2 BARLEY      1699  2  74   2.758 2.3 75  2.2 15.11 2140
NAPI          BLOCK 2 TRITI       2087  3  53   1.665 2.3 75  1.0 15.66 2724
NAPI          BLOCK 2 SM GRAIN     652  4 130   9.519 2.3 75  1.7 11.04  600
NAPI          BLOCK 2 MILO         504  5 130   9.519 2.3 75  2.1  4.95  212
NAPI          BLOCK 2 BEANS       1525  6 165  16.843 2.3 75 1.4  2.21  282
999
NAPI          TOTAL   ALFALFA     4057  1  53   1.665 2.3 75  3.4 17.95 6069
NAPI          TOTAL   BARLEY      2002  2  86   4.043 2.3 75  2.2 15.40 2570
NAPI          TOTAL   BARLEY      1699  2  74   2.758 2.3 75  2.2 15.11 2140
NAPI          TOTAL   TRITI       2686  3  53   1.665 2.3 75  1.0 15.66 3527
NAPI          TOTAL   SM GRAIN     946  4 130   9.519 2.3 75  1.7 11.04  871
NAPI          TOTAL   MILO        1008  5 130   9.519 2.3 75  2.1  4.95  424
NAPI          TOTAL   BEANS       2786  6 165  16.843 2.3 75 1.4  2.21  516
999
MEDIUM SOIL           ALFALFA     1200  1  53   1.665 2.3 75  3.4 17.95 1796
MEDIUM SOIL           BARLEY      1200  2  86   4.043 2.3 75  2.2 15.40 1542
MEDIUM SOIL           TRITI       1200  3  53   1.665 2.3 75  1.0 15.66 1567
MEDIUM SOIL           SM GRAIN    1200  4 130   9.519 2.3 75  1.7 11.04 1104
MEDIUM SOIL           MILO        1200  5 130   9.519 2.3 75  2.1  4.95  496
MEDIUM SOIL           BEANS       1200  6 165  16.843 2.3 75 1.4  2.21  223
999
```

Figure 8.-Area data file AREA before example computer run

EDITOR. DATAFORM can be used only for adding data to the end of the file. If DATAFORM is used, refer to "Initial Data Organization" for a description of the use of DATAFORM, except use the A mode in response to Select Data Mode.

Listings of the fieldman's scheduling sheets select file SELFSS, district delivery schedules select file SELDIST, and farm irrigation guide select file SELGUID are shown in figure 9. Use the EDITOR if modifications and/or additions are required.

For this example run, all tag names are listed in the CHAIN command. Tag names may be listed in a sequence. Make certain the PRINTER is ON prior to typing this command.

```
CHAIN TIMS;CLIMATE,FSS,DATA,
TURN,LAT,DIST,GUID,LIST
```

When the CLIMATE tag is used, DATAFORM will be entered. The user must enter the data onto the form per the following instructions:

```
PAGE    1      SELFSS.TXT

2 327 4.043 403 4.836 410 5.758 417 6.692
5 510 9.519 518 11.038
6 614 16.843
```

```
PAGE    1      SELDIST.TXT

NAPI
```

```
PAGE    1      SELGUID.TXT

MEDIUM SOIL
```

Figure 9.-Data files SELFSS, SELDIST, and SELGUID

a. Type: S in response to SELECT DATA MODE.
b. Type: Data onto the form shown on the CRT, figure 10.

After all data are entered,

c. Press: DISPLAY and 4 keys simultaneously.
d. Type END in response to DF-READY.
e. Type: Y in response to END FILE?
f. Type: OUT in response to DF-READY.

The user must also enter the forecast ETP values when prompted by routine PETP. The output is produced on the printer by routine PETP as the ETP is calculated on each day, figure 11. This gives the user an opportunity to note the actual ETP as it is calculated for the update period, so he can better judge the forecast ETP values. A similar table is shown on the CRT as routine PETP is run.

When the DATA tag is used, the lateral-field data entry routine PFLD will prompt the user for a code number and, if code 2 or 3 is used, the item number and corresponding data. Refer to "Program Description" for a detailed explanation of the codes and items. An alternative to using the DATA tag is to modify the lateral-field file by using the EDITOR prior to running the program. Table 4 lists the lateral-field data entered during this example update run. Only codes 1 and 2 were used in the example.

Upon completion of the CHAIN command, the results of the program should be listed on the PRINTER. If a rerun is necessary the user can retrieve the backup copies of the climate, lateral-field, and/or area files using the copy or source append commands (COPY or SAPP). Following is an example of how to retrieve a copy of the area file using the COPY command:

COPY AREAB/TXT,AREA/TXT

"Program TIMS Output" shows the program output from the example update run.

INITIAL DATA ORGANIZATION

Program TIMS requires some initial input data at the beginning of the irrigation season which must be placed onto the input data files prior to running the program. Described below is the initial data required and how this data can be placed onto the files.

For operation on a two diskette Datapoint minicomputer, place the data diskette in drive 0 and the program diskette in drive 1.

DATE: --------- MAX: --------- MIN: --------- DEW: --------- WIND: --------- SOLAR: --------- RAIN: ---------

Figure 10.-Form as displayed on CRT for entry of climate data

```
LISTED BELOW ARE THE NEW CLIMATE DATA

711   87  58  58  97.7   557   3E-2  .307   .217  23.838  192
712   92  60  60  80.1   801   0     .272   .333  24.171  193
713   96  63  53  92.9   660   0     .237   .291  24.462  194
714   98  64  53  87.4   741   0     .202   .335  24.797  195
715   98  62  56  97.4   689   0     .167   .306  25.103  196
716   92  60  55  91.2   505   1E-2  .142   .209  25.312  197
717   90  56  54  117.3  453   0     .106   .178  25.49   198
718   90  54  53  75.4   682   0     7E-2   .263  25.753  199
719   94  58  53  84.4   623   0     3.6E-2 .259  26.012  200
720   94  66  53  144.9  652   0     9E-3   .29   26.302  201
.25 .25
```

Figure 11.-Listing of new climate data produced on printer and displayed on CRT

Table 4.-Typical lateral-field data for example computer run

Water orders - Code 1

Lateral	Turnout	Date	Ft^3/s	Hours	Fields
W-11.7	0.5L	719	1.1	180	14
W-11.7	1.1R	718	1.2	108	41, 47
W-11.7	1.2R	719	1.3	48	94
W-11.7	1.2R	715	1.35	96	95
W-11.7	1.5R	722	1.3	156	2, 8
W-11.7	1.5L	721	1.6	60	16
W-11.2W	2.0R	718	2.4	216	1
W-11.2W	2.0R	716	2.6	18	8
W-11-2W	2.0R	718	2.4	216	7
W-11.2W	2.2L	722	1.2	182	2, 10
W-11.2W	2.2R	717	1.3	60	65

Change field data - Code 2

Lateral	Turnout	Field	Item	Value
W-11.7	0.6R	39	12	722
W-11.7	0.8L	45	1	42
W-11.7	0.8L	45	2	7
W-11.7	0.8L	45	3	716
W-11.7	0.8L	45	4	25.312
W-11.7	0.8L	45	5	80
W-11.7	0.8L	61	6	3.4
W-11.7	0.8L	61	11	711
W-11.7	1.1R	44	11	714
W-11.7	1.1L	66	11	713
W-11.7	1.1L	59	11	713
W-11.7	1.2R	95	11	714
W-11.7	1.5L	14	11	711
W-11.7	1.5L	15	11	711
W-11.2W	2.0R	1	11	717
W-11.2W	2.0R	7	11	719

1. **Climate Data**

The user must build a climate file, called CLDATA. The first line of this file must contain the CSUBT and TSUBX values required by the Jensen equation which calculates ETP. All succeeding lines must contain daily climate data as described in "Input Data". The file can be built using the Datapoint EDIT or BUILD commands, or the Datapoint DATAFORM system can be used as described below:

a. Type: DF11 CLDATA01,CLDATA
b. Type: S in response to Select Data Mode
c. Type: Data onto the form shown on the CRT
d. Press: DISPLAY and 4 when all data are entered
e. Type: END in response to DF-READY
f. Type: Y in response to END FILE?
g. Type: OUT in response to DF-READY

If DATAFORM is used, the EDITOR must then be used to insert the CSUBT and TSUBX values at the top of the file.

Note that a minimum of 38 days of climate data are required for proper operation of the delivery requirement portion of the TIMS program.

2. **Crop Consumptive Use Data**

The user must build a crop consumptive use file, called CROPCU. The required data are described in "Input Data". The file *must* be built using the DATAFORM system, as described below,

because the file is greater than 79 columns wide.

a. Type: DF11 CROPCU01,CROPCU
b. Type: S in response to Select Data Mode
c. Type: ETP data onto the form shown on the CRT
d. Press: DISPLAY and 1 when ETP data are finished. This loads the next form onto the CRT
e. Type: Crop name and remainder of data onto the form shown on the CRT
f. Press: DISPLAY and 4 when all data are entered
g. Type: END in response to DF-READY
h. Type: Y in response to END FILE?
i. Type: OUT in response to DF-READY

3. **Lateral-Field Data**

The user must build a lateral-field file, called LATFLD, if turnout and/or lateral schedules are desired. The data are described in "Input Data". The file can be built using the EDIT or BUILD commands, or the Datapoint DATAFORM system can be used to enter line A and line C data as described below:

a. Type: DF11 LATFLD01, LATFLD
b. Type: S in response to Select Data Mode
c. Type: Data onto the form shown on the CRT
d. Press: DISPLAY and 1 when line A data are finished. This loads the next form onto the CRT.
e. Type: End code, either 99 or 999
f. Press: DISPLAY and 1 when end code data are finished. This loads the first form-return to step c.
g. Press: DISPLAY and 4 when all data are entered
h. Type: END in response to DF-READY
i. Type: Y in response to END FILE?
j. Type: OUT in response to DF-READY

Dataform allows only for entry of line A and line C data. The field data on line B can now be entered using the editor or routine PFLD, code 3, and field data.

4. **Area Data**

The user must build an area file, called AREA, if delivery requirements are desired (district and/or guide schedules). The data are described in "Input Data". The file can be built using the EDIT or BUILD commands, or the Datapoint DATAFORM system can be used as described below:

a. Type: DF11 AREA01,AREA
b. Type: S in response to Select Data Mode
c. Type: Data onto the form shown on the CRT. Enter 999 for the area name to terminate the data for a system
d. Press: DISPLAY and 4 when all data are entered
e. Type: END in response to DF-READY
f. Type: Y in response to END FILE?
g. Type: OUT in response to DF-READY

If DATAFORM is used, the EDITOR must be used to insert a data or blank line at the top of the file.

5. **Select Data**

Using the EDIT or BUILD command, enter the proper data into select files SELFSS, SELDIST, and SELGUID as described in "Input Data".

INPUT DATA

There are seven input files required by program TIMS. The content of each of these files is described within this section. Depending upon the intended use of the TIMS program, the user may not need all the files. The following list shows the required files for various portions of the TIMS program:

A. Required files for all portions of the TIMS program:

1. Climate data - CLDATA
2. Crop consumptive use data - CROPCU

B. Required file for fieldman's scheduling sheets:

1. Select data - SELFSS

C. Required file for turnout and/or lateral schedules:

1. Lateral-field data - LATFLD

D. Required file for delivery requirements (needed to produce district and/or guide schedules):

1. Area data - AREA

E. Required file for district delivery schedules:

1. Select data - SELDIST

F. Required file for irrigation guides:

1. Select data - SELGUID

A. Climate Data - File CLDATA

The climate data required by the TIMS program are located on a file called CLDATA, figure 5. For operation of the delivery requirement portion of the program, a minimum of 38 days of climate data is required. The dewpoint temperature and wind run data are not used in the program since the Penman equation is not used. Therefore, these two items can be set to zero if desired.

The first line of the climate file contains the values for CSUBT and TSUBX, which are used in the Jensen ETP equation. The associated program variable names are C9 and T9. Also on the first line are three Julian calendar dates which are program generated. The user does not need to enter these dates.

All succeeding lines on the file contain data for each day of the growing season. The data are described below along with the associated program variable names.

Date, such as 302 for March 2 or 1009 for October 9. Ignore February 29 on leap years.	D
Maximum temperature, in °F.	T1
Minimum temperature, in °F.	T2
Dewpoint temperature, in °F.	T3
Wind run in miles per day.	W1
Solar radiation in langleys per day.	S1
Rainfall in inches.	R1

Note: The following data are computer calculated. No entries are required.

Effective rain in inches.	ER
Jensen ETP in inches.	J
Summation of Jensen ETP in inches.	E
Julian date equivalent of the date.	JU

Note: The following data are prompted by the computer after all Jensen ETP's are calculated. The user must enter appropriate values.

Average short-term forecast ETP (first forecast week) in inches.	F7
Average ETP for second forecast week in inches.	F14

B. Crop Consumptive Use Data - File CROPCU

The crop consumptive use data required by the TIMS program are located on a file called CROPCU, figure 6. This file contains summations of ET versus summation of ETP for each crop for the growing season. A maximum of 10 crops is allowed. However, if additional computer memory is available, this maximum can be increased.

The top line contains values of summation of Jensen ETP, from 0.00 through 50.00 inches. The increment is set at 5 inches. This line of data is not read by the program since the values are set within the program in variable EO. However, the line must exist on the file.

The remaining lines contain data for each crop. The data are described below along with associated program variable names.

Crop name, up to 10 characters.	C1$
Crop number, from 1 to 10.	I
A factor which is the product of the optimum depletion percentage and the maximum expected root zone, in feet, for the crop. It is used to calculate an allowable depletion on fields that do not have a predefined allowable depletion.	FA
ET adjustment, in percent. This adjustment allows for increasing or decreasing the evapotranspiration on a crop for conditions such as	ETA

failure of the crop to follow the normal ET rate. The computer applies this adjustment to the summations of ET.

Summations of ET for each summation of ETP on the top line throughout the growing season. Note that the first summation must always be zero as it represents the summation at plant. GO

C. **Lateral-Field Data - File LATFLD**

The lateral-field file contains lateral, turnout, and field data used to produce lateral and turnout schedules, figure 7.

Note that there are three different lines (A, B, and C) of information on this file. Line A contains lateral-turnout data, line B contains individual field data, and line C ends a set of data for the lateral-turnout combination. The data contained on each line of this file along with associated program variable names are as follows:

Line A - Lateral Turnout Data

Lateral name, up to 10 characters. L$

Turnout name, up to 10 characters. T$

Farm number served by lateral-turnout combination. Can be a number from 1 to 998. Need not be in sequential order. FO

Base allocation in acre-feet. BO

Maximum cubic feet per second capacity of the turnout. MO

Line B - Field Data

Field number within the farm. Can be a number from 1 to 98. Need not be in sequential order. F1

Acres in field. A1

Crop number, from 1 to 10. This number tells the computer which crop is planted in the field on the crop consumptive use file. I1

Plant date, such as 312 for March 12 or 602 for June 2. P1

Summation of ETP at plant date in inches. This value can be extracted from the climate file. E1

Irrigation efficiency, in percent. This is used by the computer for adjusting the amount of water tc apply at the forecasted irrigation. EF

Allowable depletion, in inches. This is the amount of water to be removed from the soil before an irrigation is to occur. AL

Holding capacity, in inches. If the allowable depletion is unknown, this must be entered in order for the computer to calculate an allowable based on the factor found on the crop consumptive use file. HC

Water order date, such as 401 for April 1. This is the firm water order date for the field, usually submitted by the farmer to the water district. The start and next dates are automatically set to zero by the computer when a water order is entered. 01

Order cubic feet per second. This is the flow of the water the farmer ordered corresponding to the water order date. 02

Order hours. These are the hours for the flow the farmer ordered corresponding to the water order date. 03

Start date, such as 414 for April 14. This is the date the fieldman determined the field was at a zero depletion level, using soil moisture measurement equipment and the fieldman's scheduling sheet. S1

Next date, such as 422 for April 22. This is an optional set date for the next irrigation event. N1

Line C - End Data

If data for a turnout are finished, enter a 99. F1

If data for a lateral are finished, enter a 999.	F1

D. **Area Data - File AREA**

The area file contains areawide cropping pattern data, figure 8. These data are used to produce the delivery requirement output reports; namely, the district delivery schedule and farm irrigation guide.

The data contained on this file are described below along with the associated program variable names.

Date through which the file is updated, posted by the program. This is located on the first line of the file. The user can initially enter a blank line here, or a date, whichever is desired.	D
Area name, such as a district, part of a district, lateral, etc., for which the program will be run. Up to 16 characters. Enter 999 to terminate the data for a system.	A$
System name, such as a specific sub-area or block of land for which delivery requirements are desired. Up to eight characters.	S$
Crop name. Up to 10 characters.	C$
Acres. This is the acreage of the crop in the system rounded to the nearest acre.	AC
Crop number used to reference the crop to the crop consumptive use file. Can be a number from 1 to 10.	ID
Julian plant date. This is the Julian date equivalent of the plant date, such as 71 for March 12. Ignore leap years.	JP
Summation of ETP, in inches, at the plant date. The computer will automatically post these data here if the crop has been planted within the last 38 climate days. If not planted within the last 38 days, the user must enter this summation, which can be extracted from the climate file.	E1
Base allocation, or allocated water delivery for the growing season for the crop, in acre-feet/acre.	BA
System efficiency, or water delivery efficiency, for the block of land in percent. This is applied against the calculated delivery requirements.	EF
Holding capacity, in inches. This is the average holding capacity of the soil for the block of land. An allowable depletion will be calculated from this value and the factor found on the crop consumptive use file. If the factor is zero, the allowable depletion will be set to this holding capacity (useful for crops like alfalfa).	HC
Delivery requirement summation to date, in inches. Since this is a computer-generated value, the user normally need not make an entry here.	IRS
Delivery requirement summation to date, in acre-feet. Since this is a computer generated value, the user normally need not make an entry here.	TIR

Note: The example listing of the area file shows an area named medium soil, 1,200 acres per crop. These data are used for generating the farm irrigation guide. The 1,200 acres were used for simplicity.

E. **Fieldman's Scheduling Sheets Select Data - File SELFSS**

The fieldman's scheduling sheets select data file contains a line of data for each scheduling sheet desired, figure 9. The data are described below along with the associated program variable names.

Crop number used to reference the crop to the crop consumptive use file. Can be a number from 1 to 10.	I1
Planting date, such as 430 for April 30.	P
Summation of ETP, in inches, at the plant date. This value can be extracted from the climate file.	Q

Note: Up to four pair of planting dates with summation of ETP's are allowed for each crop.

F. **District Delivery Schedules Select Data - File SELDIST**

The district delivery schedules select data file contains names of those areas for which schedules are desired, figure 9. The data are described below along with the associated program variable name.

Area name. Up to 16 characters. Z$

G. **Farm Irrigation Guide Select Data - File SELGUID**

The farm irrigation guide select data file contains names of those areas for which guides are desired, figure 9. The data are described below along with associated program variable name.

Area name. Up to 16 characters. Z$

PROGRAM TIMS OUTPUT

This section shows the output from the example update run from July 11 through July 20, inclusive.

Climate Data - File CLDATA

The climate data file CLDATA (fig. 12) includes the climate data for the update period July 11 through July 20, and the calculated effective rain, Jensen ETP, summation of ETP, and Julian date. The last day, July 20, also shows the forecast ETP values.

Lateral-Field Data - File LATFLD

Field data changes (fig. 13) were included by routine PFLD. No other data in this file were changed.

```
1.1E-2 19.83 164 192 201
101   46  27  34  61     312   0     0       3.8E-2 3.8E-2 1
102   44  19  28  38.7   250   0     0       2.1E-2 5.9E-2 2
103   48  18  30  66.2   250   0     0       2.4E-2 8.3E-2 3
104   50  24  33  86.7   250   0     0       3.1E-2 .114   4
105   52  29  30  64.7   250   0     0       3.8E-2 .152   5
106   47  31  33  95.2   250   .12   0       3.5E-2 .187   6
107   41  26  36  133.7  267   0     0       2.7E-2 .214   7
108   50  20  27  35.8   297   0     0       3.3E-2 .247   8
109   56  20  31  72.5   250   0     0       3.3E-2 .28    9
110   44  26  32  107.6  250   0     7.2E-2  2.8E-2 .308   10
111   44  27  28  130.3  250   0     6E-2    2.9E-2 .337   11
112   45  31  35  180.6  275   0     4.8E-2  3.6E-2 .373   12
113   46  24  32  111.2  275   0     3.6E-2  3E-2   .403   13

707   93  45  34  91.3   764   0     1.1E-2  .278   22.994  188
708   91  62  55  82.4   475   2E-2  2.4E-2  .199   23.193  189
709   92  58  59  95.9   550   7E-2  8.8E-2  .224   23.417  190
710   90  66  65  72     475   .23   .309    .204   23.621  191  .3   .3
711   87  58  58  97.7   557   3E-2  .307    .217   23.838  192
712   92  60  60  80.1   801   0     .272    .333   24.171  193
713   96  63  53  92.9   660   0     .237    .291   24.462  194
714   98  64  53  87.4   741   0     .202    .335   24.797  195
715   98  62  56  97.4   689   0     .167    .306   25.103  196
716   92  60  55  91.2   505   1E-2  .142    .209   25.312  197
717   90  56  54  117.3  453   0     .106    .178   25.49   198
718   90  54  53  75.4   682   0     7E-2    .263   25.753  199
719   94  58  53  84.4   623   0     3.6E-2  .259   26.012  200
720   94  66  53  144.9  652   0     9E-3    .29    26.302  201  .3   .3
```

Figure 12.-Climate data file CLDATA following example computer run.

```
W-11.7     0.5L                1                0                1.25
  14   38    2      401   4.622        75    2.2   0     719   1.1   180   0     0
  15   38    2      327   4.043        75    2.2   0     709   1.25  180   0     0
 99
W-11.7     0.6R                1                0                1.25
  39   38    1      222   1.665        75    3.4   0     709   1.25  140   0     722
  40   38    2      401   4.622        75    2.2   0     715   1.25  90    0     0
 99
W-11.7     0.8L                5                0                2.6
  45   42    7      716   25.312       80    1     0     0     0     0     0     0
  60   100   3      222   1.665        75    1     0     0     0     0     0     0
  61   15    1      222   1.665        75    3.4   0     712   2.6   24    711   0
 99
W-11.7     1.1R                7                0                1.3
  41   17    2      410   5.758        75    2.2   0     718   1.2   108   0     0
  44   25    1      222   1.665        75    3.4   0     713   1.3   84    714   0
  47   36    2      405   5.12         75    2.2   0     718   1.2   108   0     0
 99
W-11.7     1.1L                7                0                1.85
  65   23    2      327   4.043        75    0     1.8   709   1.85  72    0     0
  66   26    1      222   1.665        75    3.4   0     712   1.85  144   713   0
  59   35    1      222   1.665        75    3.4   0     712   1.85  144   713   0
  54   27    2      328   4.129        75    0     1.8   709   1.85  72    0     0
 99
W-11.7     1.2R               14                0                1.35
  94   18    1      222   1.665        60    3.4   0     719   1.3   48    0     0
  95   62    4      510   9.519        70    1.7   0     715   1.35  96    714   0
 99
W-11.7     1.5R               15                0                1.3
  2    36    5      510   9.519        70    2.1   0     722   1.3   156   0     0
  8    38    5      510   9.519        70    2.1   0     722   1.3   156   0     0
 99
W-11.7     1.5L               15                0                1.85
  14   38    1      222   1.665        70    3.4   0     710   1.8   252   711   0
  15   33    1      222   1.665        60    3.4   0     710   1.8   252   711   0
  16   39    7      630   21.082       70    2     0     721   1.6   60    0     0
 999
W-11.2W    2.0R               17                0                2.6
  1    84    1      222   1.665        50    3.4   0     718   2.4   216   717   0
  8    30    6      614   16.843       50    0     2     716   2.6   18    0     0
  7    41    1      222   1.665        50    3.4   0     718   2.4   216   719   0
 99
W-11.2W    2.0L               26                0                1.25
  21   36    3      222   1.665        70    1     0     0     0     0     0     0
  26   36    2      327   4.043        70    2.2   0     705   1.25  125   706   0
 99
W-11.2W    2.2L               28                0                1.2
  2    40    5      510   9.519        70    0     1.8   722   1.2   182   0     0
  10   30    5      512   9.819        70    0     1.8   722   1.2   182   0     0
 99
W-11.2W    2.2R                5                0                1.3
  58   38    3      222   1.665        70    0     .8    0     0     0     0     0
  65   40    6      614   16.843       70    0     2     717   1.3   60    0     0
 999
```

Figure 13. Lateral-field data file LATFLD following example computer run.

Area Data - File AREA

This file (fig. 14) has been updated through July 20, the ending date of the update period. Only the last two items, besides the date, have been modified by the program. These are the delivery requirement summations to date in both inches and acre-feet.

Fieldman's Scheduling Sheets

Using barley for an example, the four planting dates are the same as those entered into the select file SELFSS (fig. 15).

The central date is 720, which was the last climate date entered onto the climate file. The top portion of the scheduling sheet represents approximately 2 historic weeks of summation of ET for each planting date. For example:

> If the barley was planted on April 3 and last irrigated on July 10, 2.4 inches of consumptive use occurred from July 10 to July 20.

The bottom portion of the scheduling sheet represents 2 future weeks of summation of ET for each planting date. Example:

> If the barley was planted on April 3 and today is July 23, 0.6 inch of consumptive use occurred from July 20 to July 23.

The scheduling sheet can be used to determine the start date, which is the date the field was at zero depletion level. Example:

> If the crop was planted on April 10 and today is July 22 and field probing today indicates the field is depleted 3 inches, the start date is approximately July 10. (3-0.4)=2.6= July 10.

Turnout Schedules

The top portion of the output (fig. 16) shows the farm number and last climate date, and for each field the crop, acres, acre-inch/acre, and acre-feet application for the next irrigation date. Also,

```
720
NAPI          BLOCK 1 ALFALFA     4057  1  53   1.665 2.3 75  3.4  19.96 6748.6
NAPI          BLOCK 1 BARLEY      2002  2  86   4.043 2.3 75  2.2  17.44 2910.2
NAPI          BLOCK 1 TRITI       599   3  53   1.665 2.3 75  1    15.66 802
NAPI          BLOCK 1 SM GRAIN    294   4  130  9.519 2.3 75  1.7  13.43 330.4
NAPI          BLOCK 1 MILO        504   5  130  9.519 2.3 75  2.1  6.26 267
NAPI          BLOCK 1 BEANS       1261  6  165  16.843 2.3 75 1.4  3.07 324.7
999
NAPI          BLOCK 2 BARLEY      1699  2  74   2.758 2.3 75  2.2  17.03 2411.6
NAPI          BLOCK 2 TRITI       2087  3  53   1.665 2.3 75  1    15.66 2724
NAPI          BLOCK 2 SM GRAIN    652   4  130  9.519 2.3 75  1.7  13.43 730
NAPI          BLOCK 2 MILO        504   5  130  9.519 2.3 75  2.1  6.26 267
NAPI          BLOCK 2 BEANS       1525  6  165  16.843 2.3 75 1.4  3.07 391.3
999
NAPI          TOTAL   ALFALFA     4057  1  53   1.665 2.3 75  3.4  19.96 6748.6
NAPI          TOTAL   BARLEY      2002  2  86   4.043 2.3 75  2.2  17.44 2910.2
NAPI          TOTAL   BARLEY      1699  2  74   2.758 2.3 75  2.2  17.03 2411.6
NAPI          TOTAL   TRITI       2686  3  53   1.665 2.3 75  1    15.66 3527
NAPI          TOTAL   SM GRAIN    946   4  130  9.519 2.3 75  1.7  13.43 1059.4
NAPI          TOTAL   MILO        1008  5  130  9.519 2.3 75  2.1  6.26 534
NAPI          TOTAL   BEANS       2786  6  165  16.843 2.3 75 1.4  3.07 715.7
999
MEDIUM SOIL           ALFALFA     1200  1  53   1.665 2.3 75  3.4  19.96 1997
MEDIUM SOIL           BARLEY      1200  2  86   4.043 2.3 75  2.2  17.44 1746
MEDIUM SOIL           TRITI       1200  3  53   1.665 2.3 75  1    15.66 1567
MEDIUM SOIL           SM GRAIN    1200  4  130  9.519 2.3 75  1.7  13.43 1343
MEDIUM SOIL           MILO        1200  5  130  9.519 2.3 75  2.1  6.26 627
MEDIUM SOIL           BEANS       1200  6  165  16.843 2.3 75 1.4  3.07 309
999
```

Figure 14.-Area data file AREA following example computer run.

CROP = BARLEY NUMBER = 2 TODAY = 720

	PLANTING DATES			
DATE	327	403	410	417
624	6.4	6.7	7	7.1
626	5.8	6.1	6.4	6.5
628	5.4	5.7	6	6.2
630	4.9	5.2	5.6	5.7
702	4.3	4.6	4.9	5.1
704	3.7	4	4.4	4.6
706	3.1	3.4	3.7	3.9
708	2.5	2.8	3.2	3.4
710	2	2.4	2.7	2.9
712	1.5	1.7	2.1	2.3
714	1	1	1.4	1.6
716	.7	.7	.8	1.1
718	.3	.3	.3	.6
720	0	0	0	0
721	.2	.2	.2	.3
722	.4	.4	.4	.5
723	.6	.6	.6	.8
724	.8	.8	.8	1
725	1	1	1	1.2
726	1.2	1.2	1.2	1.4
727	1.5	1.5	1.5	1.6
728	1.7	1.7	1.7	1.8
729	1.9	1.9	1.9	2
730	1	2.1	2.1	2.3
731	0	2.3	2.3	2.5
801	0	2.3	2.5	2.7
802	0	1.2	2.8	2.9
803	0	.1	3	3.1

Figure 15.-Computer printout of fieldman's scheduling sheet.

the last order date is printed. The next irrigation date and application rate in ft^3/s and number of hours to irrigate are also printed.

The bottom portion of the output shows the firm water orders for a 3-day period 719 through 721. Should there be a water order in the past that is still in operation, the remaining flow and hours will be posted under the first water order date, 719. See turnout 1.1R for an example of this situation.

An area on the output has been defined for the irrigator or ditchrider to make notes regarding the actual water delivery schedule.

Lateral Schedules

Lateral schedules (fig. 17) were produced by the routine PLAT. These schedules contain the CFS data shown in the turnout schedules, except the CFS is spread from day to day if the hours exceed 24.

Irrigation District Delivery Schedule

Following is a reduced copy of the district delivery schedule (fig. 18) produced by the routine PDIST. An explanation of the contents is as follows:

SYSTEM. - Identification of specific subarea or portion of delivery system.

ACRES. - Total area irrigated in acres.

BASE ALLOCATION. - The yearly allocation of water to be delivered to the irrigated area in acre-feet.

CU SEASONAL, CU TO DATE. - Weighted crop consumptive use in acre-feet based on cropping pattern for the system. CU SEASONAL is the projected crop consumptive use for the full growing season. CU TO DATE is the crop consumptive use from the beginning of the growing season to the present date based on current climatic conditions.

DIVERSIONS TO DATE. - For each subarea or portion of the system, the diversions since the beginning of the irrigation season to the current date can be recorded in acre-feet. This allows the district personnel to make comparisons with the Base Allocation, Consumptive Use, and Delivery Requirement.

DELIVERY REQUIREMENT:

TO DATE, TODAY. - The computed delivery requirement in acre-feet is based on the cropping pattern of the subarea, climatic conditions including effective rainfall, and system efficiency. TO DATE is the sum of the daily delivery requirement since the beginning of the growing season to the current date. TODAY is the delivery requirement of the current date.

FORECAST. - Projection of the daily delivery requirement for the next 7 days based on cropping pattern, system efficiency, and normal or long-term climatic conditions. The forecast does not consider future rainfall, but does reflect past effective rainfall that has occurred.

Farm Irrigation Guide

This guide (fig. 19) was produced by the program to indicate the next irrigation dates based upon delivery requirements on each crop. The requirements are calculated from climate conditions, including past effective rainfall. The column labeled ET is a function of the average short-term forecast ETP.

LATERAL W-11.7 TURNOUT 0.5L FARM 1 DATE 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
14	BARLEY	38	2.9	9.1	719	730	1.3	88
15	BARLEY	38	3.7	11.7	709	722	1.3	109

	WATER ORDERS						FORECAST TURNOUT SCHEDULE									
TURNOUT	719		720		721		722		723		724		725		726	
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS
0.5L	1.1	180	0	0	0	0	1.3	109	0	0	0	0	0	0	0	0
FIELDS	14						15									

NOTES FOR IRRIGATORS WATER ORDERS

LATERAL W-11.7 TURNOUT 0.6R FARM 1 DATE 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
39	ALFALFA	38	4	12.6	709	722	1.3	122
40	BARLEY	38	2.9	9.1	715	727	1.3	85

	WATER ORDERS						FORECAST TURNOUT SCHEDULE									
TURNOUT	719		720		721		722		723		724		725		726	
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS
0.6R	0	0	0	0	0	0	1.3	122	0	0	0	0	0	0	0	0
FIELDS							39									

NOTES FOR IRRIGATORS WATER ORDERS

Figure 16.-Computer printout of turnout schedule. (Sheet 1 of 6)

LATERAL: W-11.7 TURNOUT: 0.8L FARM: 5 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
45	NEW ALF	42	1.3	4.5	0	722	2.6	21
60	TRITI	100	0	0	0	0	0	0
61	ALFALFA	15	4.5	5.6	712	725	2.6	26

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
TURNOUT	719		720		721		722		723		724		725		726			
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
0.8L	0	0	0	0	0	0	2.6	21	0	0	0	0	2.6	26	0	0		
FIELDS							45						61					

NOTES FOR IRRIGATORS WATER ORDERS

LATERAL: W-11.7 TURNOUT: 1.1R FARM: 7 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
41	BARLEY	17	2.9	4.1	718	729	1.3	38
44	ALFALFA	25	4.5	9.3	713	729	1.3	87
47	BARLEY	36	2.9	8.7	718	729	1.3	81

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
TURNOUT	719		720		721		722		723		724		725		726			
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
1.1R	1.2	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
FIELDS	41 47																	

NOTES FOR IRRIGATORS WATER ORDERS

Figure 16.-Computer printout of turnout schedule. (Sheet 2 of 6)

LATERAL: W-11.7 TURNOUT: 1.1L FARM: 7 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
65	BARLEY	23	3.7	7	709	722	1.9	46
66	ALFALFA	26	4.5	9.7	712	728	1.9	62
59	ALFALFA	35	4.5	13.1	712	728	1.9	84
54	BARLEY	27	3.7	8.3	709	722	1.9	53

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
TURNOUT	719		720		721		722		723		724		725		726			
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
1.1L	0	0	0	0	0	0	1.9	99	0	0	0	0	0	0	0	0		
FIELDS							65 54											

NOTES FOR IRRIGATORS WATER ORDERS

LATERAL: W-11.7 TURNOUT: 1.2R FARM: 14 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
94	ALFALFA	18	5.7	8.5	719	802	1.4	76
95	SM GRAIN	62	2.4	12.4	715	722	1.4	107

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
TURNOUT	719		720		721		722		723		724		725		726			
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
1.2R	1.3	48	0	0	0	0	1.4	107	0	0	0	0	0	0	0	0		
FIELDS	94						95											

NOTES FOR IRRIGATORS WATER ORDERS

Figure 16.-Computer printout of turnout schedule. (Sheet 3 of 6)

LATERAL: W-11.7 TURNOUT: 1.5R FARM: 15 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
2	MILO	36	3	9	722	731	1.3	84
8	MILO	38	3	9.5	722	731	1.3	89

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
TURNOUT	719		720		721		722		723		724		725		726			
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
1.5R	0	0	0	0	0	0	1.3	156	0	0	0	0	0	0	0	0		
FIELDS							2 8											

NOTES FOR IRRIGATORS WATER ORDERS

LATERAL: W-11.7 TURNOUT: 1.5L FARM: 15 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
14	ALFALFA	38	4.9	15.5	710	725	1.9	102
15	ALFALFA	33	5.7	15.6	710	725	1.9	100
16	NEW ALF	39	2.9	9.4	721	727	1.9	60

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
TURNOUT	719		720		721		722		723		724		725		726			
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
1.5L	1.8	36	0	0	1.6	60	0	0	0	0	0	0	1.9	202	0	0		
FIELDS	14 15				16								14 15					

NOTES FOR IRRIGATORS WATER ORDERS

Figure 16.-Computer printout of turnout schedule. (Sheet 4 of 6)

LATERAL: W-11.2W TURNOUT: 2.0R FARM: 17 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
1	ALFALFA	84	6.8	47.6	718	731	2.6	222
8	BEANS	30	2.4	6	716	725	2.6	28
7	ALFALFA	41	6.8	23.2	718	802	2.6	108

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
	719		720		721		722		723		724		725		726			
TURNOUT	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
2.0R	2.4	192	0	0	0	0	0	0	0	0	0	0	2.6	28	0	0		
FIELDS	1 7												8					

NOTES FOR IRRIGATORS WATER ORDERS

LATERAL: W-11.2W TURNOUT: 2.0L FARM: 26 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
21	TRITI	36	0	0	0	0	0	0
26	BARLEY	36	5.1	15.3	705	722	1.3	143

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
	719		720		721		722		723		724		725		726			
TURNOUT	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
2.0L	0	0	0	0	0	0	1.3	143	0	0	0	0	0	0	0	0		
FIELDS							26											

NOTES FOR IRRIGATORS WATER ORDERS

Figure 16.-Computer printout of turnout schedule. (Sheet 5 of 6)

LATERAL: W-11.2W TURNOUT: 2.2L FARM: 28 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
2	MILO	40	3.1	10.3	722	731	1.2	104
10	MILO	30	3.1	7.7	722	801	1.2	78

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
TURNOUT	719		720		721		722		723		724		725		726			
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
2.2L	0	0	0	0	0	0	1.2	182	0	0	0	0	0	0	0	0		
FIELDS							2 10											

NOTES FOR IRRIGATORS WATER ORDERS

LATERAL: W-11.2W TURNOUT: 2.2R FARM: 5 DATE: 720

FIELD NO.	CROP	ACRES	IRRIGATION REQ. AC-IN/AC	IRRIGATION REQ. AC-FT	LAST ORDER	NEXT IRRIGATION DATE	NEXT IRRIGATION CFS	NEXT IRRIGATION HRS
58	TRITI	38	0	0	0	0	0	0
65	BEANS	40	1.8	6	717	725	1.3	56

	WATER ORDERS						FORECAST TURNOUT SCHEDULE											
TURNOUT	719		720		721		722		723		724		725		726			
	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS		
2.2R	1.3	12	0	0	0	0	0	0	0	0	0	0	1.3	56	0	0		
FIELDS	65												65					

NOTES FOR IRRIGATORS WATER ORDERS

Figure 16.-Computer printout of turnout schedule. (Sheet 6 of 6)

LATERAL: W-11.7 DATE: 720

	WATER ORDERS (CFS)						FORECAST LATERAL SCHEDULE (CFS)											
TURNOUT	719		720		721		722		723		724		725		726			
	MEAS	ORD	MEAS	ORD	MEAS	ORD	MEAS	FOR	MEAS	FOR	MEAS	FOR	MEAS	FOR	MEAS	FOR		
0.5L		1.1		1.1		1.1		1.3		1.3		1.3		1.3		1.3		
0.6R		0		0		0		1.3		1.3		1.3		1.3		1.3		
0.8L		0		0		0		2.6		0		0		2.6		0		
1.1R		1.2		1.2		1.2		1.2		0		0		0		0		
1.1L		0		0		0		1.9		1.9		1.9		1.9		0		
1.2R		1.3		1.3		0		1.4		1.4		1.4		1.4		0		
1.5R		0		0		0		1.3		1.3		1.3		1.3		1.3		
1.5L		1.8		1.8		1.6		1.6		1.6		0		1.9		1.9		
TOTAL CFS		5.4		5.4		3.9		12.6		8.8		7.2		11.7		5.7		

LATERAL: W-11.2W DATE: 720

	WATER ORDERS (CFS)						FORECAST LATERAL SCHEDULE (CFS)											
TURNOUT	719		720		721		722		723		724		725		726			
	MEAS	ORD	MEAS	ORD	MEAS	ORD	MEAS	FOR	MEAS	FOR	MEAS	FOR	MEAS	FOR	MEAS	FOR		
2.0R		2.4		2.4		2.4		2.4		2.4		2.4		2.6		2.4		
2.0L		0		0		0		1.3		1.3		1.3		1.3		1.3		
2.2L		0		0		0		1.2		1.2		1.2		1.2		1.2		
2.2R		1.3		0		0		0		0		0		1.3		1.3		
TOTAL CFS		3.7		2.4		2.4		4.9		4.9		4.9		6.4		6.2		

Figure 17.-Computer printout of lateral schedules.

IRRIGATION DISTRICT DELIVERY SCHEDULE DATE: 720

LOCATION: NAPI NOTE: ALL DATA IN ACRE FEET

SYSTEM	ACRES	BASE ALLOCATION	CU SEASONAL	CU TO-DATE	DIVERSIONS TO-DATE	DELIVERY REQUIREMENT TO-DATE	TODAY	FORECAST DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
BLOCK 1	8717	20049.1	19907.7	11446		15177.2	179.6	185.1	190.5	196	201.4	206.8	212.3	217.7
BLOCK 2	6467	14874.1	9359.4	6706.4		8698.53	83.6	50.9	54	57.2	60.3	63.5	66.6	69.8
TOTAL	15184	34923.2	29267.2	18152.5		23875.3	263.2	235.9	244.5	253.1	261.7	270.3	278.9	287.5

Figure 18.-Computer printout of irrigation district delivery schedule.

FARM IRRIGATION GUIDE CONTAINING NEXT IRRIGATION DATES DATE: 720

MEDIUM SOIL

CROP	PLANT DATE	ALLOW DEPL.	ET	DATE OF LAST IRRIGATION 708	710	712	714	716	718	INTERVAL LAST	INTERVAL NEXT
ALFALFA	222	3.4	.26	723	725	726	728	730	731	15	13
BARLEY	327	2.6	.22	721	722	724	726	728	730	12	12
TRITI	222	0	0	0	0	0	0	0	0	0	0
SM GRAIN	510	2	.31	716	718	720	721	723	725	8	7
MILO	510	2.5	.24	722	723	725	726	728	729	15	11
BEANS	614	.9	.2	716	718	720	721	722	723	8	5

Figure 19.-Computer printout of farm irrigation guide.

Appendix A.-TIMS CHAIN File

```
//.
//. HELLO!  WELCOME TO THE DATAPOINT TIMS PROGRAM.
//.
// IFS CLIMATE
//. NOW MAKING BACKUP COPY (CLDATAB) OF THE CLIMATE FILE (CLDATA)
SAPP CLDATA,,CLDATAB
//. NOW ENTERING DATAFORM FOR CLIMATE DATA ENTRY
DF11 CLDATA01,CLDATA;A
//. NOW LOADING/RUNNING ETP PROGRAM
DOSBASIC PETP
// XIF
// IFS FSS
//. NOW LOADING/RUNNING FIELDMAN'S SCHEDULING SHEET PROGRAMS
DOSBASIC PFMS
// XIF
// IFS DATA
//. NOW MAKING BACKUP COPY (LATFLDB) OF THE LATERAL-FIELD FILE (LATFLD)
SAPP LATFLD,,LATFLDB
//. NOW LOADING/RUNNING LATERAL-FIELD DATA ENTRY PROGRAM
DOSBASIC PFLD
// XIF
// IFS TURN,LAT
//. NOW LOADING/RUNNING CALC. PROGRAMS FOR TURNOUT AND/OR LATERAL SCHEDULING
DOSBASIC PCAL
// XIF
// IFS TURN
//. NOW LOADING/RUNNING TURNOUT PRINTOUT PROGRAM
DOSBASIC PTUR
// XIF
// IFS LAT
//. NOW LOADING/RUNNING LATERAL PRINTOUT PROGRAM
DOSBASIC PLAT
// XIF
// IFS DIST,GUID
//. NOW MAKING BACKUP COPY (AREAB) OF THE AREA FILE (AREA)
SAPP AREA,,AREAB
//. NOW LOADING/RUNNING CALC. PROGRAMS FOR DELIVERY REQUIREMENT SCHEDULING
DOSBASIC PCALDR
// XIF
// IFS DIST
//. NOW LOADING/RUNNING IRR. DISTRICT DELIVERY SCHEDULE PRINTOUT PROGRAM
DOSBASIC PDIST
// XIF
// IFS GUID
//. NOW LOADING/RUNNING FARM IRRIGATION GUIDE PRINTOUT PROGRAM
DOSBASIC PGUID
// XIF
// IFS LIST
//. NOW LISTING CLIMATE FILE -CLDATA-
LIST CLDATA;LX
CLIMATE FILE
//. NOW LISTING LATERAL-FIELD FILE - LATFLD-
LIST LATFLD;LX
LATERAL-FIELD FILE
//. NOW LISTING AREA FILE -AREA-
LIST AREA;LX
AREA FILE
// XIF
//. $$$$$$$$$$$$  ALL DONE   $$$$$$$$$$$$$
```

Appendix B.-TIMS Program BASIC Language Listings

The listings of the 14 separate BASIC language routines which make up the TIMS program follow. Each listing contains comments, preceded by dollar signs ($) or asterisks (*), to assist the reader in understanding the BASIC language code.

```
$
$ Program PETP reads the climate data file (CLDATA), and for all new climate
$   days calculates the Jensen etp, sum etp to date, and daily effective rain.
$   The data are printed on the CRT as they are calculated.
$   After the last new day, the program prompts the user for the forecast etp
$   values. Intermediate file (INTER) is used to contain all data until
$   calculations are completed, and then is copied back onto the climate file.
$
10 DIM X$[78],RR[10],PG$[1],LF$[1],Y[13]
*
* Month end julian calendar dates are defined.
*
20 READ Y[1],Y[2],Y[3],Y[4],Y[5],Y[6],Y[7],Y[8],Y[9],Y[10],Y[11],Y[12],Y[13]
30 DATA 0,31,59,90,120,151,181,212,243,273,304,334,365
*
* Open the climate file (CLDATA) and intermediate file (INTER).
*
40 OPEN#1,"CLDATA/TXT:DR0"
50 OPEN#2,"INTER/TXT:DR0"
*
* Headings are printed on CRT and PRINTER, and variables are initalized.
*
60 PRINT "DATE","JENSEN ETP","SUM ETP    EFFECTIVE RAIN"
70 SM=N=M=K=IC=0;PG$[1]=12;LF$[1]=10
80 PRINT#4;PG$;" LISTED BELOW ARE THE NEW CLIMATE DATA";LF$
*
* Read past CSUBT and TSUBX, on climate file.
*
90 INPUT#1,C9,T9
100 IF EOF#1 THEN 700
*
* Search for number of total days on climate file.
*
110 INPUT#1,D,X,X,X,X,X,X,X,J
120 IF EOF#1 THEN 190
130 N=N+1
* The rain flag M is set to 10 if no etp's are on the climate file.
```

```
140 IF N=1 AND J=0 THEN M=10
150 IF J>0 THEN 110
160 IF M>0 THEN 110
170 M=N
180 GO 110
*
* If M=0 there are no new climate days.
*
190 IF M=0 THEN 720
*
* M = rain flag. Also close and reopen climate data file.
*
200 N1=0:M=M-S
210 END#1
220 OPEN#1,"CLDATA/TXT:DR0"
*
* Read CSUBT and TSUBX and print on intermediate file.
*
230 INPUT#1,C9,T9
240 PRINT#2;C9;T9
*
* Read climate data.
*
250 INPUT#1,D,T1,T2,T3,W1,S1,R1,ER,J,E,JU,F7,F14
260 IF EOF#1 THEN 740
*
* Find julian calendar date, if necessary.
*
270 IF JU>0 THEN 290
280 MO=INT(D/100):JU=Y[MO]+(D-(MO*100))
*
* Check rain flag.
*
290 N1=N1+1
300 IF N1<M THEN 330
*
* Store rain.
*
```

```
310 K=K+1
320 RA[K]=R1
*
* Store total etp to-date.
*
330 IF J>0 THEN SM=E
340 IF J>0 THEN 540
*
* Calculate JENSEN etp = J.
*
350 IC=IC+1
360 T=(T1+T2)/2
370 J=((C9*(T-T9)*S1))*.000673
380 J=(INT(J*1000)/1000)
*
* Sum etp to-date.
*
390 SM=SM+J
*
* Set effective rain to zero, store today's julian date and the first
*  julian date of the update period.
*
400 ER=0
410 JU3=JU: IF IC=1 THEN JU2=JU
420 IF N1<10 THEN 510
* Calculate effective rain and store.
430 FOR L=1 TO 10
440 ER1=RA[L]*(L/10)
450 ER=ER+ER1
460 NEXT L
470 FOR L=1 TO 9
480 RA[L]=RA[L+1]
490 NEXT L
500 K=9
*
* Print calculated data on CRT and PRINTER.
*
510 PRINT D, J, SM, ER
```

```
520 PRINT#4; D; TAB 6; T1; TAB 10; T2; TAB 14; T3; TAB 18; W1; TAB 26; S1; TAB 33;
530 PRINT#4; R1; TAB 39; ER; TAB 47; J; TAB 53; SM; TAB 61; JU
*
* If last climate day, produce audible CLICKS and ask for forecast etp's.
*
540 IF N1<N THEN 630
550 FOR I=1 TO 100
560 CLICK
570 NEXT I
580 PRINT "ENTER AVERAGE SHORT TERM FORECAST ETP: ";
590 INPUT F7
600 PRINT "ENTER AVERAGE ETP FOR 2ND FORECAST WEEK: ";
610 INPUT F14
*
* Store forecast etp's for printing later.
*
620 F1=F7; F2=F14
*
* Print the climate and etp data onto the intermediate file.
*
630 IF F7>0 OR F14>0 THEN 670
640 PRINT#2; D; TAB 6; T1; TAB 10; T2; TAB 14; T3; TAB 18; W1; TAB 26; S1; TAB 33;
650 PRINT#2; R1; TAB 39; ER; TAB 47; J; TAB 53; SM; TAB 61; JU
660 GO 250
670 PRINT#2; D; TAB 6; T1; TAB 10; T2; TAB 14; T3; TAB 18; W1; TAB 26; S1; TAB 33;
680 PRINT#2; R1; TAB 39; ER; TAB 47; J; TAB 53; SM; TAB 61; JU; TAB 66; F7; TAB 72; F14
690 GO 250
*
* Error messages.
*
700 PRINT " THERE ARE NO DATA ON THE CLIMATE FILE"
710 GO 870
720 PRINT " THERE ARE NO NEW CLIMATE DAYS ON THE CLIMATE FILE"
730 GO 870
*
* Close and open intermediate and climate files.
*
740 END#2
```

```
750 END#1
760 OPEN#1, "CLDATA/TXT:DR0"
770 OPEN#2, "INTER/TXT:DR0"
*
* Read first line on intermediate file, calculate 38th day ago julian
*   date, and print on the climate file.
*
780 INPUT#2, C9, T9
790 JU1=(JU3-38)+1
*
* Copy climate data from intermediate file back onto climate file.
*
800 PRINT#1; C9; T9; JU1; JU2; JU3
810 INPUT#2, X$
820 IF EOF#2 THEN 850
830 PRINT#1, X$
840 GO 810
*
* Print the forecast etp values on the PRINTER, and close the climate file.
*
850 PRINT#4; F1; F2
860 END#1
*
* Return control to DISK OPERATING SYSTEM.
*
870 DOS
GO
```

```
$
$ Program PFMS prepares the input data required by program PFMS1 which
$  generates the fieldman's scheduling sheets. The climate data file (CLDATA),
$  crop consumptive use file (CROPCU), and select fieldman's scheduling sheet
$  file (SELFSS) are used.
$
10 DIM E[42],C1$[10],E0[11],G0[11],Y[13],D(42),LF$(1),PG$(1)
20 DIM P(4),Q(4),H(4,28)
*
* Month end julian calendar dates and 5 inch incremental sum etp's are defined.
*
*
30 READ Y[1],Y[2],Y[3],Y[4],Y[5],Y[6],Y[7],Y[8],Y[9],Y[10],Y[11],Y[12],Y[13]
40 DATA 0,31,59,90,120,151,181,212,243,273,304,334,365
50 READ E0(1),E0(2),E0(3),E0(4),E0(5),E0(6),E0(7),E0(8),E0(9),E0(10),E0(11)
60 DATA 0,5,10,15,20,25,30,35,40,45,50
70 RESTORE
*
* Define printer controls and open climate file (CLDATA).
*
80 LF$(1)=10:PG$(1)=12
90 OPEN#1,"CLDATA/TXT:DR0"
*
* Read past unneeded climate data.
*
100 INPUT#1,X,X,JU1
110 INPUT#1,X,X,X,X,X,X,X,X,X,X,JU
120 IF JU<(JU1+9) THEN 110
*
* Read last 28 days of climate data from climate file. These data are the
*  date, sum etp to-date, julian date, and forecast etp values.
*
130 FOR I=1 TO 28
140 INPUT#1,D(I),X,X,X,X,X,X,X,X,E(I),JU,F7,F14
150 NEXT I
*
* For each forecast day (29 thru 42) calculate the date and sum etp.
```

```
*
160 L=0
170 FOR I=29 TO 42
180 L=L+1
190 M=JU+L
200 FOR K=1 TO 13
210 IF M<=Y(K) THEN 230
220 NEXT K
230 K=K-1:D(I)=(K*100)+(M-Y(K))
240 IF L<=7 THEN E[I]=E(I-1)+F7
250 IF L>7 THEN E[I]=E(I-1)+F14
260 NEXT I
*
* Close the climate file, and open the select fieldman's scheduling sheet
*  (SELFSS) and crop consumptive use (CROPCU) files.
*
270 END#1
280 OPEN#1,"SELFSS/TXT:DR0"
290 OPEN#2,"CROPCU/TXT:DR0"
*
* Read past the first line on the consumptive use file.
*
300 INPUT#2,X
*
* Load and compile remainder of program (PFMS1).
*
310 APP "PFMS1"
GO
```

```
$
$ Program PFMS1 performs the calculations for the fieldman's scheduling
$  sheets. Selected crops are read from the select file, and for each crop
$  a fieldman's scheduling sheet is produced on the PRINTER.
$
*
* Clear unneeded coding from memory prior to loading remainder of program.
*
:D 10-310
*
* Initalize and read select fieldman's scheduling sheet file (SELFSS).
*  The data are: crop number, plant date, and sum etp at plant.
*  Up to four sets of data are allowed.
*
10 I=0
20 INPUT#1, I1, P(1), Q(1), P(2), Q(2), P(3), Q(3), P(4), Q(4)
30 IF EOF#1 THEN 690
*
* Initalize arrays.
*
40 FOR J=1 TO 4
50 FOR K=1 TO 28
60 H(J,K)=0
70 NEXT K
80 NEXT J
*
* If necessary, read consumptive use file (CROPCU) until correct crop data is
*  found. Then store the data in array G0.
*
90 IF I1=I THEN 140
100 INPUT#2, C1$, I, X, ETA, A, BB, C, DD, F, GG, HH, II, JJ, K, L
110 IF I1<>I THEN 100
120 G0(1)=A: G0(2)=BB: G0(3)=C: G0(4)=DD: G0(5)=F: G0(6)=GG: G0(7)=HH: G0(8)=II:
130 G0(9)=JJ, G0(10)=K, G0(11)=L
*
* Print headings on the PRINTER.
*
```

```
140 PRINT#4,PG$;"CROP = ";TAB 7;C1$;TAB 21;"NUMBER = ";TAB 30;I1;TAB 36;
150 PRINT#4,"TODAY = ";TAB 44;D(28);LF$
160 PRINT#4,"          ---------- PLANTING DATES ----------";LF$
170 PRINT#4,TAB 9;P(1);TAB 19;P(2);TAB 29;P(3);TAB 39;P(4)
180 PRINT#4,"DATE";LF$
*
* Calculate historic sum et for each plant date for each of the past 28 days.
*
190 FOR J=1 TO 4
* Check if plant date is zero or not yet planted.
200 IF P(J)=0 OR P(J)>D(28) THEN 290
210 FOR K=28 TO 1 STEP -1
* Check sum etp against sum etp at plant.
220 IF E(K)<Q(J) THEN 290
* Call subroutine to find sum et.
230 GOSUB 660
* Terminate check.
240 IF G1>1 AND G0(G1)=0 THEN 290
* Calculate.
250 IF K=28 THEN 270
260 H(J,K)=H(J,K+1)+G3-G:IF H(J,K)<0 THEN H(J,K)=0
270 G3=G
280 NEXT K
290 NEXT J
* Round the calculated results, and print on the PRINTER.
300 FOR K=2 TO 28 STEP 2
310 IF K=28 THEN PRINT#4
320 FOR J=1 TO 4
330 H(J,K)=(INT(H(J,K)*10)/10)
340 NEXT J
350 PRINT#4,D(K);TAB 9;H(1,K);TAB 19;H(2,K);TAB 29;H(3,K);TAB 39;H(4,K)
360 NEXT K
*
* Print blank line on the PRINTER for today.
*
370 PRINT#4
*
* Initalize arrays.
```

```
*
380 FOR J=1 TO 4
390 FOR K=1 TO 28
400 H(J,K)=0
410 NEXT K
420 NEXT J
*
* Calculate forecast sum etp for each plant date for the next 15 days.
*
430 FOR J=1 TO 4
* Plant date check.
440 IF P(J)=0 THEN 570
450 IF P(J)>D(28) THEN 570
* Loop for each of the forecast days.
460 FOR K=28 TO 42
470 IF E(K)<Q(J) THEN 560
* Call subroutine to find sum et.
480 GOSUB 660
* Terminate check.
490 IF G1>1 AND G0(G1)=0 THEN 570
* Day counter and check.
500 L=K-28: IF K=28 THEN 550
510 IF K>29 THEN 530
520 H(J,L)=G-G3: GO 540
530 H(J,L)=H(J,L-1)+G-G3
540 IF H(J,L)<0 THEN H(J,L)=0
550 G3=G
560 NEXT K
570 NEXT J
* Round the calculated results, and print on the PRINTER.
580 FOR K=29 TO 42
590 L=K-28
600 FOR J=1 TO 4
610 H(J,L)=(INT(H(J,L)*10)/10)
620 NEXT J
630 PRINT#4: D(K); TAB 9; H(1,L); TAB 19; H(2,L); TAB 29; H(3,L); TAB 39; H(4,L)
```

```
* Loop for next crop.
*
650 GO 20
*
* Subroutine to interpolate crop consumptive use data to find sum et to-date.
*  The et adjustment (ET) is also applied.
*
660 E6=E(K)-Q(J); G1=E6/5; G1=INT(G1)+1; G2=G1+1
670 G=G0(G1)+(((E6-E0(G1))/5))*(G0(G2)-G0(G1)); G=G*ETA/100
680 RETURN
*
* Close the select file and return control to the Disk Operating System.
*
690 END#1
700 DOS
GO
```


pages tightly bound

```
$
$ Program PFLD provides an interactive method for updating the lateral-field
$  file (LATFLD). Intermediate files are produced each time the user cycles
$  thru one of the codes noted below. These intermediate files are called
$  LATFLDn, where n is 1-9.
$
10 DIM L$[10], T$[10], L1$[10], T1$[10], F[6], A$[1], R$[7], S$[7], B$[70], A1$[1]
*
* Initalize lateral-field file names. R$ is always the read file, S$ is
*  always the write file. Also initalize file counter.
*
20 R$="LATFLD "; S$="LATFLD1"
30 II=0
*
* Print code table on CRT. Up to 9 code cycles are allowed.
*
40 PRINT "CODE        FUNCTION"
50 PRINT "----       ----------"
60 PRINT "  1        WATER ORDERS"
70 PRINT "  2        CHANGE FIELD DATA"
80 PRINT "  3        ADD FIELD DATA"
90 PRINT "  4        STOP"
*
* Prompt for the desired code number.
*
100 PRINT "THE CODES ARE LISTED ABOVE - TYPE THE CODE YOU WANT: ";
110 INPUT C
*
* If code 4, STOP.
*
120 IF C=4 THEN 1270
*
* Open input and output lateral-field files.
*
130 OPEN#1, R$
140 OPEN#2, S$
*
```

```
* Branch for codes 2 and 3.
*
150 IF C=2 THEN 560
160 IF C=3 THEN 920
*
* Code 1 - water orders.
*
* Call subroutine to read and write line A of the file.
170 GOSUB 190
180 GO 230
* Subroutine to read and write line A of the file.
190 INPUT#1, L$, T$, F0, B0, M0
200 IF EOF#1 THEN 1230
210 PRINT#2; L$; T$; TAB 25; F0; TAB 35; B0; TAB 45; M0
220 RETURN
* Print lateral and turnout names on CRT and prompt if any water orders.
*  Y means yes, N means no, O means out (COPY remainder of file and
*  cycle for another code).
230 PRINT " "
240 PRINT "LATERAL="; L$; " TURNOUT="; T$
250 PRINT "ANY WATER ORDERS - TYPE Y OR N OR O: ";
260 INPUT A$
270 IF A$="O" THEN 1190
280 IF A$="Y" THEN 380
* No orders for turnout, so read and write all its field data. When 99
*  card is reached the turnout is finished.
290 INPUT#1, F1, A1, I1, P1, E1, EF, AL, HC, O4, O5, O6, S1, N1
300 IF F1>98 THEN PRINT#2; F1
310 IF F1>98 THEN 170
* Call subroutine to write the field data onto the file.
320 GOSUB 340
330 GO 290
* Subroutine to write the field data onto the file.
340 PRINT#2; TAB 1; F1; TAB 5; A1; TAB 10; I1; TAB 15; P1; TAB 20; E1; TAB 30; EF;
350 PRINT#2; TAB 35; AL; TAB 40; HC; TAB 45; O4; TAB 50; O5; TAB 55; O6; TAB 60; S1;
360 PRINT#2; TAB 65; N1
370 RETURN
* Water orders are desired, so prompt for the date, cfs, and hours.
```

```
380 PRINT "ENTER ORDER DATE, CFS, HOURS:  ";
390 INPUT O1, O2, O3
* Prompt for the field numbers the water is delivered to. Up to 6 are allowed.
400 PRINT "ENTER FIELD NUMBERS:  ";
410 INPUT F[1], F[2], F[3], F[4], F[5], F[6]
* Read the field data from the file.
420 INPUT#1, F1, A1, I1, P1, E1, EF, AL, HC, O4, O5, O6, S1, N1
430 IF F1<99 THEN 490
* End of the turnout is encountered, so print message on CRT if desired
*  fields cannot be found.
440 FOR I=1 TO 6
450 IF F[I]>0 THEN PRINT "**** FIELD ";F[I];" IS MISSING - IT IS IGNORED ****"
460 NEXT I
470 PRINT#2;F1
480 GO 170
* Check field numbers.
490 FOR I=1 TO 6
500 IF F1=F[I] THEN 540
510 NEXT I
* No match, so call subroutine to write data on file and cycle for next field.
520 GOSUB 340
530 GO 420
* Match, so place new water order data into variables, initalize, and call
*  subroutine to write data. Then cycle for next field.
540 O4=O1; O5=O2; O6=O3; F[I]=S1=N1=0
550 GO 520
*
* Code 2 - change field data.
*
* Call subroutine to read and write line A of the file.
560 GOSUB 190
* Print lateral and turnout names on CRT and prompt if any changing field data.
*  Y means yes, N means no, O means out (copy remainder of file and cycle for
*  another code).
570 PRINT " "
580 PRINT "LATERAL=";L$;"  TURNOUT=";T$
590 PRINT "ANY CHANGING FIELD DATA - TYPE Y OR N OR O:  ";
600 INPUT A$
```

```
* Read the field data from the file.
610 INPUT#1, F1, A1, I1, P1, E1, EF, AL, HC, 04, 05, 06, S1, N1
620 IF F1>98 THEN PRINT#2; F1
630 IF F1>98 THEN 560
640 IF A$="Y" THEN 680
* No changing data for lateral/turnout, so write the data on the file and
*   cycle.
650 GOSUB 340
660 IF A$="O" THEN 1190
670 GO 610
* Print field numbers on CRT, and prompt if changes.
680 PRINT "FIELD= "; F1; " ANY CHANGES - TYPE Y OR N: ";
690 INPUT A1$
700 IF A1$="Y" THEN 730
* No changing data for field, so write the data on the file, and cycle.
710 GOSUB 340
720 GO 610
* Changes are desired, so prompt for the item number and value.
730 PRINT "ENTER ITEM NO. AND VALUE: ";
740 INPUT J1, J2
* If item number is zero, no more changes for field, so write the data on the
*   file and cycle.
750 IF J1>0 THEN 780
760 GOSUB 340
770 GO 610
* Depending upon the item number, load value into proper variable.
*   Print error message on CRT if items 8, 9, or 10 are used here.
780 IF J1=1 THEN A1=J2
790 IF J1=2 THEN I1=J2
800 IF J1=3 THEN P1=J2
810 IF J1=4 THEN E1=J2
820 IF J1=5 THEN EF=J2
830 IF J1=6 THEN AL=J2
840 IF J1=7 THEN HC=J2
850 IF J1<8 OR J1>10 THEN 890
860 PRINT " ITEMS 8, 9, AND 10 ARE NOT ALLOWED UNDER CODE 2"
870 PRINT " USE CODE 1 FOR WATER ORDERS"
880 GO 730
```

```
890 IF J1=11 THEN S1=J2
900 IF J1=12 THEN N1=J2
910 GO 730
*
* Code 3 - add field data.
*
* Prompt for lateral and turnout names, and farm and field numbers.
*  If lateral is blank, copy remainder of file and cycle for new code.
920 PRINT " "
930 PRINT "ENTER LATERAL: ";
940 INPUT L1$
950 IF L1$="          " THEN 1190
960 PRINT "ENTER TURNOUT: ";
970 INPUT T1$
980 PRINT "ENTER FARM NO. AND FIELD NO.: ";
990 INPUT F2,F3
* Call subroutine to read and write line A of the file.
1000 GOSUB 190
* Read and write the field data until end of turnout is encountered.
1010 INPUT#1,F9,A1,I1,P1,E1,EF,AL,HC,O4,O5,O6,S1,N1
1020 IF F9>98 THEN 1050
1030 F1=F9:GOSUB 340
1040 GO 1010
* End of turnout, so check lateral and turnout names, and farm numbers.
1050 IF L$=L1$ AND T$=T1$ AND F0=F2 THEN 1080
1060 PRINT#2:F9
1070 GO 1000
* Everything matches, so prompt for values of items 1-12, and write the data
*  onto the file.
1080 PRINT "ENTER VALUES FOR ITEMS 1 THRU 12: ";
1090 INPUT A1,I1,P1,E1,EF,AL,HC,O4,O5,O6,S1,N1
1100 F1=F3:GOSUB 340
* Prompt for more fields.
1110 PRINT " "
1120 PRINT "IS THERE ANOTHER NEW FIELD ON THIS TURNOUT - TYPE Y OR N: ";
1130 INPUT A$
1140 IF A$="N" THEN PRINT#2:F9
1150 IF A$="N" THEN 920
```

```
* More fields, so prompt for field number and cycle for values.
1160 PRINT "ENTER FIELD NO.: ";
1170 INPUT F3
1180 GO 1080
* End of processing for a code, so copy remainder of input file onto
*  output file.
1190 INPUT#1,B$
1200 IF EOF#1 THEN 1230
1210 PRINT#2,B$
1220 GO 1190
*
* Copy complete, so close the file, increment file counter and file names,
*  and then cycle for another code.
*
1230 END#2
1240 END#1
1250 II=II+1:IF II>8 THEN 1270
1260 R$[7]=48+II:S$[7]=49+II:GO 40
*
* Code 4 - stop
*
1270 IF II=0 THEN 1350
* Open last file used and copy it back to the original lateral-field file.
1280 S$[7]=32:OPEN#1,R$
1290 OPEN#2,S$
1300 INPUT#1,B$
1310 IF EOF#1 THEN 1340
1320 PRINT#2,B$
1330 GO 1300
*
* Copy complete - close the lateral-field file and return control to the
*  Disk Operating System.
*
1340 END#2
1350 DOS
GO
```

```
$
$ Program PCAL prepares the input data from both the climate (CLDATA) and
$  crop consumptive use (CROPCU) files for use in program PCAL1, which
$  calculates the dates and amounts of the next irrigation events on each
$  field.
$
10 DIM A$(20),E[42],C1$[10],E0[11],G0[10,11],Y[13],FR(10),ETR(10)
*
* Month end julian calendar dates and 5 inch incremental sum etr's are defined.
*
20 READ Y[1],Y[2],Y[3],Y[4],Y[5],Y[6],Y[7],Y[8],Y[9],Y[10],Y[11],Y[12],Y[13]
30 DATA 0,31,59,90,120,151,181,212,243,273,304,334,365
40 READ E0(1),E0(2),E0(3),E0(4),E0(5),E0(6),E0(7),E0(8),E0(9),E0(10),E0(11)
50 DATA 0,5,10,15,20,25,30,35,40,45,50
60 RESTORE
*
* Open climate file (CLDATA).
*
70 OPEN#1,"CLDATA/TXT:DR0"
*
* Read julian dates and read past unneeded climate data.
*
80 INPUT#1,X,X,JU1,X,JU3
90 INPUT#1,X,X,X,X,X,X,X,X,X,X,JU
100 IF JU<(JU1+9) THEN 90
*
* Read last 28 days of climate data from the climate file. These data are the
*  date, sum etr to-date, julian date, and forecast etr values.
*
110 FOR I=1 TO 28
120 INPUT#1,D,X,X,X,X,X,X,X,X,E(I),JU,F7,F14
130 IF I>1 THEN 150
* Store 1st of 28 days: D1=date, J1=julian date.
140 D1=D:J1=JU
150 NEXT I
*
* Calculate average etr over last 28 days. D3=last date.
```

```
160 A0=(E(28)-E(1))/28: D3=D
*
* For each forecast day (29 thru 42) calculate the sum etf.
*
170 L=0
180 FOR I=29 TO 42
190 L=L+1
200 IF L<=7 THEN E[I]=E(I-1)+F7
210 IF L>7 THEN E[I]=E(I-1)+F14
220 NEXT I
*
* Close the climate file.
*
240 END#1
*
* Open the crop consumptive use file (CROPCU).
*
250 OPEN#1,"CROPCU/TXT:DR0"
*
* Read past the first line on the consumptive use file.
*
260 INPUT#1,X
*
* Read consumptive use file data, and store into G0 array.
*  Also store the decimal value of the et adjustment.
*
270 INPUT#1,C1$,I,FF,ET,A,B,C,D,F,G,H,II,JJ,K,L
280 IF EOF#1 THEN 320
290 G0(I,1)=A: G0(I,2)=B: G0(I,3)=C: G0(I,4)=D: G0(I,5)=F: G0(I,6)=G: G0(I,7)=H
300 G0(I,8)=II: G0(I,9)=JJ: G0(I,10)=K: G0(I,11)=L: FA(I)=FF: ETA(I)=ET/100
310 GOTO 270
*
* Close the crop consumptive use file, and open the lateral-field (LATFLD) and
*  intermediate (INTER) files.
*
320 END#1
330 OPEN#1,"LATFLD/TXT:DR0"
340 OPEN#2,"INTER/TXT:DR0"
```

```
*
* Write today's date onto the intermediate file.
*
350 PRINT#2:D3:JU3
*
* Load and compile remainder of program (PCAL1).
*
360 APP "PCAL1"
GO
```

```
$
$ Program PCAL1 uses climate and crop consumptive use data to produce dates
$  and amounts of next irrigation events for each field on the lateral-field
$  file (LATFLD). The calculated data are placed onto the intermediate file
$  (INTER) which is then used in program PCAL2.
$
*
* Clear unneeded codins from memory prior to loadins remainder of program.
*
:D 10-360
*
* Read lateral/turnout names and farm number from lateral-field file.
*
10 INPUT#1,A$,F0
20 IF EOF#1 THEN 570
*
* Read field data from lateral-field file.
*
30 INPUT#1,F1,A1,I1,P1,E1,EF,AL,HC,O1,X,X,S1,N1
40 IF F1>98 THEN 10
*
*
* Beginnins of field processing.
*
*
* If order is zero, set order = plant date.
50 IF O1=0 THEN O1=P1
* Set efficiency to decimal value, initalize, and check if planted.
60 EF=EF/100:G3=0:G4=0:G5=0:N7=0:A7=0:IF P1>D3 THEN 550
* E6=(sum etp at 2nd forecast day - etp at plant). Call subroutine to find
*   sum et.
70 E6=E(30)-E1:GOSUB 280
* If sum et at plant is zero, then not yet planted.
80 G2P=G2:IF G2P=0 THEN 550
*
* Set variables for each date (order, start, next).
*
```

```
90 FOR J=1 TO 3
100 IF J>1 THEN 130
* Dates
110 D=01: IF P1<>01 THEN 150
120 G3=0: GO 200
130 IF J=2 THEN D=S1
140 IF J=3 THEN D=N1
150 IF D=0 THEN 200
* Call subroutine to find sum et from plant to proper date.
160 GOSUB 240
* Load sum et into proper variable.
170 IF J=1 THEN G3=G2
180 IF J=2 THEN G4=G2
190 IF J=3 THEN G5=G2
200 NEXT J
*
* If next date is set, next irr. = next date and amount to apply
*  is = ((sum et at next date - sum et at order or start date)/efficiency).
*
210 IF N1=0 THEN 300
220 N7=N1: G2=G3: IF S1>0 THEN G2=G4
230 A7=(G5-G2)/EF: GO 550
*
* Subroutine to find julian calendar date (J2) and date index (I).
*  If date is more than 14 days away, skip.
*
240 M=INT(D/100): J2=Y(M)+(D-(M*100)): I=J2-J1+1: IF I>42 THEN 550
250 IF I>0 THEN 270
* Date is in the past, so find sum etp at date using average etp over last
*  28 days.
260 I=1: E(I)=E(I)-((J1-J2)*A0)
* E6=(sum etp at date-sum etp at plant).
270 E6=E(I)-E1
*
* Subroutine to interpolate crop consumptive use data to find sum
*  et to-date (G2). The et adjustment (ETA) is also applied.
*
280 G1=E6/5: G1=INT(G1)+1: G2=G1+1
```

```
290 G2=G0[I1,G1]+(((E6-E0[G1])/5))*(G0[I1,G2]-G0[I1,G1]):G2=G2*ETA(I1):RETURN
*
* Calculate allowable depletion, if not preset.
*
300 IF AL>0 THEN 340
310 M=INT(O1/100):J3=Y(M)+(O1-(M*100)):M=INT(P1/100):J2=Y(M)+(P1-(M*100))
320 G2=FA(I1)*HC:AL=(.33*G2)+(G2*((J3-J2)/60)):IF (J3-J2)<0 THEN AL=.33*G2
330 IF AL>G2 THEN AL=G2
*
* Calculate sum et at next irrigation (G7), based on allowable and sum et
*  at order (G3) or sum et at start (G4).
*
340 G7=G3+(AL/ETA(I1)):IF S1>0 THEN G7=G4+(AL/ETA(I1))
*
* Check crop consumptive use data to find position I based on sum et (G7).
*
350 FOR I=1 TO 11
360 IF G7<G0(I1,I) THEN 400
370 IF I>1 AND G0(I1,I)=0 THEN 550
380 NEXT I
* If I>11 then next irr. is beyond terminate.
390 IF I>11 THEN 550
*
* Interpolate crop consumptive use data to find sum etp (E7) at position I.
*
400 J=I-1:E7=E0[J]+((G7-G0[I1,J])/(G0[I1,I]-G0[I1,J])*5):E7=E7+E1
*
* Past due check. If sum etp (E7) at next irr. is past, next irr. is set to
*  today + 2 days and amt. to apply is = (sum et at plant - sum et at order or
*  start).
*
410 IF E7>=E[28] THEN 440
420 J=JU3+2:G2=G3:IF S1>0 THEN G2=G4
430 A7=(G2P-G2)/EF:GO 510
*
* Not past due. No forecast if beyond 14 days away.
*
440 IF E7<=E[42] THEN 460
```

```
450 GO 550
*
* Find date of next irrigation (N7), where E7 = sum et at next irrigation.
*  A 2 day allowance is given for ordering water. A7 = amt. to apply =
*  (allowable depl./efficiency).
*
460 FOR J=29 TO 42
470 IF E7<E(J) THEN 490
480 NEXT J
490 IF J<30 THEN J=30
500 I=J-28: J=JU3+I: A7=AL/EF
510 FOR I=1 TO 13
520 IF J<=Y(I) THEN 540
530 NEXT I
540 I=I-1: N7=(I*100)+(J-Y[I])
*
* Write the results onto the intermediate file (INTER): farm number,
*  field number, next irrigation date, amount to apply.
*
550 PRINT#2: F0: F1: N7: A7
*
*
* End of field processing. Loop for next field.
*
*
560 GO 30
*
* Finished. Close lateral-field and intermediate files, and compile
*  remainder of program (PCAL2).
*
570 END#2
580 END#1
590 END#3
600 GET "PCAL2"
GO
```

```
$
$ Program PCAL2 uses the intermediate file (INTER), which was produced in
$  program PCAL1, and crop consumptive use data to calculate required data
$  for turnout and lateral scheduling. The lateral-field file (LATFLD)
$  is used. The calculated data are placed onto a new intermediate file
$  (INTER1). As each turnout is processed, the lateral and turnout names
$  are printed on the CRT.

$
10 DIM A$[20], Y[13], DA[8], F$[8,12], CF[8], HR[8], C1$[10], C2$[10,10], LOR(10)
*
* Month end dates are defined.
*
20 READ Y[1], Y[2], Y[3], Y[4], Y[5], Y[6], Y[7], Y[8], Y[9], Y[10], Y[11], Y[12], Y[13]
30 DATA 0,31,59,90,120,151,181,212,243,273,304,334,365
40 RESTORE
*
* Open the crop consumptive use file (CROPCU).
*
50 OPEN#1,"CROPCU/TXT:DR0"
* Read past 1st line.
60 INPUT#1, I
* Read and store the crop names.
70 INPUT#1, C1$, I
80 IF EOF#1 THEN 130
90 FOR J=1 TO 10
100 C2$[I,J]=C1$[J]
110 NEXT J
120 GO 70
* Close the crop consumptive use file.
130 END#1
*
* Open the lateral-field file (LATFLD), intermediate file (INTER - created
*  in program PCAL1), and the new intermediate file (INTER1).
*
140 OPEN#1,"LATFLD/TXT:DR0"
150 OPEN#2,"INTER/TXT:DR0"
```

```
160 OPEN#3,"INTER1/TXT:DR0"
*
* Read todays date and julian date from the intermediate file.
*
170 INPUT#2,D3,JU3
*
* Calculate the eight dates needed for printing schedules, and write onto
*  the new intermediate file.
*
190 FOR I=1 TO 8
200 J4=JU3+I-2
210 FOR J=1 TO 13
220 IF J4<=Y[J] THEN 240
230 NEXT J
240 J=J-1:DA[I]=(J*100)+(J4-Y[J])
250 NEXT I
260 PRINT#3:D3;JU3;DA[1];DA[2];DA[3];DA[4];DA[5];DA[6];DA[7];DA[8]
*
* Read lateral/turnout names, farm number, base allocation, and max.
*  delivery from lateral-field file.
*
270 INPUT#1,A$,F0,B0,M0
280 IF EOF#1 THEN 900
*
* Initalize arrays.
*
290 FOR I=1 TO 8
300 FOR J=1 TO 12
310 F$[I,J]=32:IF J=12 THEN F$[I,J]=124
320 NEXT J
330 CF[I]=0:HR[I]=0
340 NEXT I
350 FOR I=1 TO 10
360 LOR(I)=0
370 NEXT I
380 NU=PA=0
*
* Print lateral/turnout name on CRT.
```

```
*
390 PRINT A$
*
*
* Process data for each field on turnout.
*
*
* Read field date from lateral-field file.
400 INPUT#1,F1,A1,I1,P1,X,X,X,X,O1,O2,O3
410 IF F1>98 THEN 840
* Round order cfs.
420 O2=(INT((O2+.05)*10)/10)
* Read next irr. date and amount to apply from intermediate file.
430 INPUT#2,X,X,N2,A2
* Round amount to apply.
440 A2=(INT((A2+.05)*10)/10)
* Calculate ac-ft (C1), round, and calculate cfs (C2).
450 C1=A2*A1/12:C1=(INT(C1*10)/10):C2=INT(((C1/(1.98*M0))*24)+.5)
* Round max. delivery and set to C3. If next irr. is zero, max is zero.
460 M0=(INT((M0+.05)*10)/10):C3=M0:IF N2=0 THEN C3=0
* Print calculated data for the field onto the new intermediate file.
470 PRINT#3:F0;F1;N2;A2;C2$[I1];C1;C2;C3
*
* If water order, calculate and store data.
*
480 IF O1=0 THEN 710
* Find water order index, and branch.
490 M=INT(O1/100):JO=Y[M]+(O1-(M*100)):JOR=JO:JO=JO-JU3+2
500 IF JO>8 THEN 710
510 IF JO>=2 THEN 690
520 IF JO=1 THEN 610
530 JO=1
* Water order is past. Check if there was a prior one (LOR) on the turnout.
540 FOR I=1 TO 10
550 IF JOR<LOR(I) THEN 710
560 IF JOR=LOR(I) THEN 700
570 NEXT I
* Calculate hours left to run on past water order.
```

```
580 X=(JU3-JOR)-1: IF (X*24)>=03 THEN 710
* Store cfs, hours, and number of past water orders and date. Call subroutine
*  to store field numbers.
590 CF(JO)=02: HR(JO)=03-(X*24): NU=NU+1: LOR(NU)=JOR: PA=1: GOSUB 750
600 GO 710
* Water order on 1st day. Store data.
610 NU=NU+1: LOR(NU)=JOR: CF(JO)=02: HR(JO)=03: IF PA=1 THEN 640
620 GOSUB 750
630 GO 710
* Blank out field number storage if new water order on 1st day.
640 FOR J=1 TO 12
650 F$(JO, J)=32: IF J=12 THEN F$(JO, J)=124
660 NEXT J
* Initalize past counter and call subroutine to store field numbers.
670 PA=0: GOSUB 750
680 GO 710
* Water order on day 2-8. Store data and call subroutine to store field
*  numbers.
690 CF(JO)=02: HR(JO)=03
700 GOSUB 750
*
* If next irrigation, calculate and store data.
*
710 IF N2=0 THEN 400
* Find next irrigation index, call subroutine to store field numbers, and
*  store data.
720 M=INT(N2/100): JO=Y[M]+(N2-(M*100)): JO=JO-JU3+2: IF JO>8 THEN 400
730 GOSUB 750
740 GO 830
*
* Subroutine to store field numbers.
*
750 FOR J=2 TO 11 STEP 3
* Check for vacancy.
760 IF F$[JO, J]=" " THEN 790
770 NEXT J
780 GO 820
* Store in storage array F$.
```

```
790 F$[JO,J-1]=48+INT(F1/10):F$[JO,J]=48+F1
800 IF F1>9 THEN F$[JO,J]=48+(F1-(10*(INT(F1/10))))
810 IF F1<10 THEN F$[JO,J-1]=32
820 RETURN
*
* Store cfs, hours sum, and loop for next field.
*
830 CF[JO]=M0:HR[JO]=HR[JO]+C2:GO 400
*
*
* End of turnout. Write calculated data for turnout onto new intermediate file.
*
*
* 99 or 999
840 PRINT#3;F1
* Cfs  and hours for 8 days.
850 PRINT#3;CF[1];HR[1];CF[2];HR[2];CF[3];HR[3];CF[4];HR[4];CF[5];HR[5];
860 PRINT#3;CF[6];HR[6];CF[7];HR[7];CF[8];HR[8]
* Field numbers associated with cfs and hours for 8 days.
870 PRINT#3;F$[1];F$[2];F$[3];F$[4]
880 PRINT#3;F$[5];F$[6];F$[7];F$[8]
*
* Loop for new turnout.
*
890 GO 270
*
* Close new intermediate file, and return control to Disk Operatins System.
*
900 END#3
910 DOS
GO
```

```
$
$ Program PTUR uses data from the new intermediate file (INTER1), produced
$  in program PCAL2, and data from the lateral-field file (LATFLD) to
$  generate turnout schedules. These turnout schedules are produced on
$  the PRINTER.
$
10 DIM L$[10], T$[10], C$[10], Y[8], V[8], W[8], Z$[4], Z0$[1], Z1$[12], F$[8,12]
20 DIM PG$[1], LF$[1]
*
* Initalize print storage arrays.
*
30 Z0$="|"; Z$="    |"; Z1$="  CFS  HRS |"; PG$[1]=12; LF$[1]=10; Q=4
*
* Open lateral-field file (LATFLD) and intermediate file (INTER1).
*
40 OPEN#1, "LATFLD/TXT:DR0"
50 OPEN#2, "INTER1/TXT:DR0"
*
* Read dates from intermediate file.
*
60 INPUT#2, D3, X, Y[1], Y[2], Y[3], Y[4], Y[5], Y[6], Y[7], Y[8]
*
* Read lateral and turnout names, farm number, base allocation, and max.
*  delivery from lateral-field file.
*
70 INPUT#1, L$, T$, F0, B0, M0
80 IF EOF#1 THEN 460
*
* Print headings for turnout printout on PRINTER.
*
90 PRINT#Q; PG$; " LATERAL: "; L$; "  TURNOUT: "; T$; "  FARM: "; F0; "  DATE: "; D3
100 PRINT#Q; LF$; TAB 31; "IRRIGATION REQ."; TAB 53; "LAST"; TAB 66; "NEXT IRRIGATION"
110 PRINT#Q; " FIELD NO.   CROP     ACRES   AC-IN/AC  AC-FT       ORDER";
120 PRINT#Q; "          DATE     CFS    HRS"; LF$
*
* Read field data for field from lateral-field file.
*
```

```
130 INPUT#1, F1, A1, I1, X, X, X, X, X, O1
140 IF F1>98 THEN 190
*
* Read calculated data for field from intermediate file, and print on PRINTER.
*
150 INPUT#2, X, X, N2, A2, C$, C1, C2, C3
160 PRINT#Q; TAB 3; F1; TAB 10; C$; TAB 21; A1; TAB 31; A2; TAB 40; C1; TAB 52;
170 PRINT#Q; O1; TAB 64; N2; TAB 73; C3; TAB 79; C2
180 GO 130
*
* Read calculated data for turnout from intermediate file.
*
* 99 or 999.
190 INPUT#2, F1
* Cfs and hours for 8 days.
200 INPUT#2, V[1], W[1], V[2], W[2], V[3], W[3], V[4], W[4], J, K, L, M, N, O, P, R
210 V[5]=J; W[5]=K; V[6]=L; W[6]=M; V[7]=N; W[7]=O; V[8]=P; W[8]=R
* Field numbers associated with cfs and hours for 8 days.
220 INPUT#2, F$[1], F$[2], F$[3], F$[4]
230 INPUT#2, F$[5], F$[6], F$[7], F$[8]
*
* Print turnout data on PRINTER.
*
240 PRINT#Q; LF$; LF$; LF$; LF$; LF$; TAB 15; Z0$; TAB 28; "WATER ORDERS"; TAB 51; Z0$;
250 PRINT#Q; TAB 69; "FORECAST TURNOUT SCHEDULE"; TAB 111; "|"
260 PRINT#Q; TAB 10; Z0$; TAB 46; Z0$; TAB 106; "|"
270 PRINT#Q; "  TURNOUT |"; TAB 15; Y[1]; Z$; TAB 27; Y[2]; Z$; TAB 39; Y[3]; Z$;
280 PRINT#Q; TAB 51; Y[4]; Z$; TAB 63; Y[5]; Z$; TAB 75; Y[6]; Z$; TAB 87; Y[7];
290 PRINT#Q; Z$; TAB 99; Y[8]; TAB 106; "|"
300 PRINT#Q; TAB 10; Z0$; TAB 11; Z1$; TAB 23; Z1$; TAB 35; Z1$; TAB 47; Z1$;
310 PRINT#Q; TAB 59; Z1$; TAB 71; Z1$; TAB 83; Z1$; TAB 95; Z1$
320 PRINT#Q; T$; TAB 10; Z0$; TAB 12; V[1]; TAB 17; W[1]; TAB 22; Z0$; TAB 24;
330 PRINT#Q; V[2]; TAB 29; W[2]; TAB 34; Z0$; TAB 36;
340 PRINT#Q; V[3]; TAB 41; W[3]; TAB 46; Z0$; TAB 48; V[4]; TAB 53; W[4]; TAB 58; Z0$;
350 PRINT#Q; TAB 60; V[5]; TAB 65; W[5]; TAB 70; Z0$; TAB 72; V[6]; TAB 77; W[6];
360 PRINT#Q; TAB 82; Z0$; TAB 84; V[7]; TAB 89; W[7]; TAB 94; Z0$; TAB 96; V[8];
370 PRINT#Q; TAB 101; W[8]; TAB 106; Z0$
380 PRINT#Q; TAB 10; Z0$; TAB 22; Z0$; TAB 34; Z0$; TAB 46; Z0$; TAB 58; Z0$; TAB 70; Z0$;
```

```
390 PRINT#Q; TAB 82; Z0$; TAB 94; Z0$; TAB 106; Z0$
400 PRINT#Q; "  FIELDS  |"; F$[1]; F$[2]; F$[3]; F$[4]; F$[5]; F$[6]; F$[7]; F$[8]
410 PRINT#Q; TAB 10; Z0$; TAB 22; Z0$; TAB 34; Z0$; TAB 46; Z0$; TAB 58; Z0$; TAB 70; Z0$;
420 PRINT#Q; TAB 82; Z0$; TAB 94; Z0$; TAB 106; Z0$
430 PRINT#Q; TAB 12; "NOTES FOR IRRIGATORS WATER ORDERS"; TAB 46; Z0$;
440 PRINT#Q; TAB 58; Z0$; TAB 70; Z0$; TAB 82; Z0$; TAB 94; Z0$; TAB 106; Z0$
*
* Loop for next turnout.
*
450 GO 70
*
* Print head-of-form on PRINTER, and return control to Disk Operating System.
*
460 PRINT#Q; PG#
470 DOS
GO
```

```
$
$ Program PLAT uses data from the new intermediate file (INTER1), produced
$  in program PCAL2, and data from the lateral-field file (LATFLD) to
$  generate lateral schedules. These lateral schedules are produced on
$  the PRINTER.
$
10 DIM L$[10], T$[10], DA[8], CF[8], HR[8], SUM[8], EQ[8], Z0$[1], Z$[4], Z1$[12]
20 DIM Z2$(12), PG$[1], LF$[1]
*
* Initalize print storage arrays.
*
30 Z0$="|"; Z$="    |"; Z1$=" MEAS  ORD |"; Z2$=" MEAS  FOR |"; PG$[1]=12; LF$[1]=10
35 Q=4
*
* Open lateral-field file (LATFLD) and intermediate file (INTER1).
*
40 OPEN#1, "LATFLD/TXT:DR0"
50 OPEN#2, "INTER1/TXT:DR0"
*
* Read dates from intermediate file.
*
60 INPUT#2, D3, X, DA[1], DA[2], DA[3], DA[4], DA[5], DA[6], DA[7], DA[8]
*
* Initalize F1 variable.
*
70 F1=999
*
* Read lateral and turnout names, farm number, base allocation, and max.
*  delivery from lateral-field file.
*
80 INPUT#1, L$, T$, F0, B0, M0
90 IF EOF#1 THEN 760
100 IF F1<998 THEN 280
*
* Print headings for lateral printout on PRINTER.
*
110 PRINT#Q; PG$;" LATERAL:  "; L$;"  DATE:  "; D3; LF$
```

```
120 PRINT#Q; TAB 10; Z0$; TAB 20; "WATER ORDERS (CFS)"; TAB 46; Z0$; TAB 61;
130 PRINT#Q; "FORECAST LATERAL SCHEDULE (CFS)"; TAB 106; "|"
140 PRINT#Q; TAB 10; Z0$; TAB 46; Z0$; TAB 106; "|"
150 PRINT#Q; "  TURNOUT |"; TAB 15; DA[1]; Z$; TAB 27; DA[2]; Z$; TAB 39; DA[3]; Z$;
160 PRINT#Q; TAB 51; DA[4]; Z$; TAB 63; DA[5]; Z$; TAB 75; DA[6]; Z$; TAB 87; DA[7];
170 PRINT#Q; Z$; TAB 99; DA[8]; TAB 106; "|"
180 PRINT#Q; TAB 10; Z0$; TAB 11; Z1$; TAB 23; Z1$; TAB 35; Z1$; TAB 47; Z2$;
190 PRINT#Q; TAB 59; Z2$; TAB 71; Z2$; TAB 83; Z2$; TAB 95; Z2$
* Call subroutine to print space lines on PRINTER.
200 GOSUB 220
210 GO 250
*
* Subroutine to print space lines on PRINTER.
*
220 PRINT#Q; TAB 10; Z0$; TAB 22; Z0$; TAB 34; Z0$; TAB 46; Z0$; TAB 58; Z0$;
230 PRINT#Q; TAB 70; Z0$; TAB 82; Z0$; TAB 94; Z0$; TAB 106; Z0$
240 RETURN
*
* Initalize arrays.
*
250 FOR I=1 TO 8
260 SUM[I]=0; EQ[I]=0
270 NEXT I
*
* Read past field numbers on lateral-field and intermediate files.
*
280 INPUT#1, F1
290 IF F1>98 THEN 310
300 GO 280
310 INPUT#2, F1
320 IF F1>98 THEN 340
330 GO 310
*
* Read cfs and hours for 8 days from intermediate file.
*
340 INPUT#2, A, B, C, D, E, G, H, I, J, K, L, M, N, O, P, R
350 CF[1]=A; HR[1]=B; CF[2]=C; HR[2]=D; CF[3]=E; HR[3]=G; CF[4]=H; HR[4]=I
360 CF[5]=J; HR[5]=K; CF[6]=L; HR[6]=M; CF[7]=N; HR[7]=O; CF[8]=P; HR[8]=R
```

```
*
* Read past field numbers associated with cfs and hours for 8 days on
*  intermediate file.
*
370 INPUT#2,X
380 INPUT#2,X
*
* Calculate equivalent cfs for each turnout for each day of the 8 day period.
*
390 FOR I=1 TO 8
* If hours <= 24 or 8th day, no spread necessary.
400 IF HR(I)<=24 OR I=8 THEN 490
* Find Y2 = number of required days for event.
410 Y1=HR(I)/24:Y2=INT(Y1):Y3=Y1-Y2:IF Y2=1 THEN 480
420 Y2=Y2-1
* Spread cfs over intermediate days of event.
430 FOR J=1 TO Y2
440 IF (I+J)>8 THEN 490
450 EQ(I+J)=EQ(I+J)+CF(I)
460 NEXT J
470 Y2=Y2+1:IF (I+Y2)>8 THEN 490
* Last day of event.
480 IF Y3>=.5 THEN EQ(I+Y2)=EQ(I+Y2)+CF(I)
* First day of event.
490 EQ(I)=EQ(I)+CF(I)
500 NEXT I
*
* Limit daily cfs to max. delivery for turnout, and round.
*
510 FOR I=1 TO 8
520 IF EQ(I)>M0  THEN EQ(I)=M0
530 EQ(I)=(INT((EQ(I)+.05)*10)/10)
540 NEXT I
*
* Print equivalent cfs for turnout on PRINTER.
*
550 PRINT#0:T$;TAB 10;Z0$;TAB 17;EQ[1];TAB 22;Z0$;
560 PRINT#0;TAB 29;EQ[2];TAB 34;Z0$;
```

```
570 PRINT#Q; TAB 41; EQ[3]; TAB 46; Z0$; TAB 53; EQ[4]; TAB 58; Z0$;
580 PRINT#Q; TAB 65; EQ[5]; TAB 70; Z0$; TAB 77; EQ[6];
590 PRINT#Q; TAB 82; Z0$; TAB 89; EQ[7]; TAB 94; Z0$;
600 PRINT#Q; TAB 101; EQ[8]; TAB 106; Z0$
* Call subroutine to print space lines on PRINTER.
610 GOSUB 220
*
* Sum the equivalent cfs for each of the 8 days.
*
620 FOR I=1 TO 8
630 SUM(I)=SUM(I)+EQ(I): EQ(I)=0
640 NEXT I
*
* If not end of lateral, loop for another turnout.
*
650 IF F1<999 THEN 80
*
* End of lateral, round the sums.
*
660 FOR I=1 TO 8
670 SUM(I)=(INT(SUM(I)*10)/10)
680 NEXT I
*
* Print the total cfs for the lateral.
*
* Call subroutine to print space lines on PRINTER, and print totals.
690 GOSUB 220
700 GOSUB 220
710 PRINT#Q; " TOTAL CFS"; TAB 10; Z0$; TAB 16; SUM(1); TAB 22; Z0$; TAB 28; SUM(2);
720 PRINT#Q; TAB 34; Z0$; TAB 40; SUM[3]; TAB 46; Z0$; TAB 52; SUM[4]; TAB 58; Z0$;
730 PRINT#Q; TAB 64; SUM[5]; TAB 70; Z0$; TAB 76; SUM[6]; TAB 82; Z0$; TAB 88; SUM[7];
740 PRINT#Q; TAB 94; Z0$; TAB 100; SUM[8]; TAB 106; Z0$
*
* Loop for next lateral.
*
750 GO 80
*
* Print head-of-form on PRINTER, and return control to Disk Operating System.
```

```
*
760 PRINT#0,PG$
770 DOS
GO
```

```
$
$ Program PCALDR prepares data from the climate (CLDATA) and crop consumptive
$  use (CROPCU) files for use in program PCALDR1 which calculates delivery
$  requirements. The area file (AREA) and new temporary area file (INTER2)
$  are also prepared here.
$
10 DIM A$[16], S$[8], E[39], C$[10], E0[11], ETA[10], G0[10,11], FA[10], ER[38]
*
* 5 inch incremental sum etp's are defined.
*
20 READ E0[1], E0[2], E0[3], E0[4], E0[5], E0[6], E0[7], E0[8], E0[9], E0[10], E0[11]
30 DATA 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50
40 RESTORE
*
* Open climate file (CLDATA).
*
50 OPEN#1, "CLDATA/TXT:DR0"
*
* Read julian dates and read past unneeded climate data.
*
60 INPUT#1, X, X, JU1, JU2, JU3
70 INPUT#1, X, X, X, X, X, X, X, X, X, X, JU
80 IF JU<(JU1-1) THEN 70
*
* Initalize K variable.
*
90 K=0
*
* Read last 38 days of climate data from the climate file. These data are the
*  date, effective rain, sum etp to-date, and forecast etp.
*
100 FOR I=1 TO 38
110 INPUT#1, D, X, X, X, X, X, X, ER[I], X, E[I], X, F1
120 NEXT I
*
* Calculate the total etp for the first 7 forecast days.
*
```

```
130 F1=F1*7
*
* Close the climate file and open the crop consumptive use file (CROPCU).
*
140 END#1
150 OPEN#1,"CROPCU/TXT:DR0"
*
* Read past first line on the crop consumptive use file.
*
160 INPUT#1,X
*
* Read crop consumptive use file data, and store into G0 array. Also store
*  the decimal value of the et adjustment.
*
170 INPUT#1,C$,I,FF,ET,A,B,C,DD,F,G,H,II,J,K,L
180 IF EOF#1 THEN 220
190 G0[I,1]=A:G0[I,2]=B:G0[I,3]=C:G0[I,4]=DD:G0[I,5]=F:G0[I,6]=G:G0[I,7]=H
200 G0[I,8]=II:G0[I,9]=J:G0[I,10]=K:G0[I,11]=L:FA[I]=FF:ETA[I]=ET/100
210 GO 170
*
* Close the crop consumptive use file, and open the area file (AREA).
*
220 END#1
230 OPEN#1,"AREA/TXT:DR0"
*
* Read the first line of the area file.
*
240 INPUT#1,X
*
* Open the temporary updated area file (INTER2).
*
250 OPEN#2,"INTER2/TXT:DR0"
*
* Write todays date onto the temporary updated area file.
*
260 PRINT#2:D
*
* Load and compile remainder of program (PCALDR1).
```

```
*
270 APP "PCALDR1"
GO
```

```
$
$ Program PCALDR1 generates a new temporary area file (INTER2) by calculating
$   the irrigation requirements for the update period. The irrigation require-
$   ment sum-to-date is read from the area file (AREA). An intermediate
$   file (INTER) is also produced which contains data required for the
$   district PDIST and guide PGUID programs. Program PCALDR2 will copy the new
$   temporary area file back to the area file. As each crop is processed,
$   the area, system, and crop names are printed on the CRT.
$
*
* Clear unneeded coding from memory prior to loading remainder of program.
*
:D 10-270
*
* Open the intermediate file (INTER), and write todays date and julian date.
*
10 OPEN#3,"INTER/TXT:DR0"
20 PRINT#3,D;JU3
*
* initalize counter N which is the number of crops on a system.
*
30 N=0
*
* Read crop data from area file.
*
40 INPUT#1,A$,S$,C$,AC,ID,JP,E1,BR,EF,HC,IRS,TIR
50 IF EOF#1 THEN 610
*
* Initalize variables.
*
60 AL=ET=IV=IR=G2=N2=FET=0:IF A$="999" THEN 580
*
* Write area name on the temporary updated area file.
*
70 IF N=0 THEN PRINT#3;A$
*
* Check if planted.
```

```
*
80 IF JP>JU3 THEN 430
*
* Calculate K which is initial loop index representing start of update period.
*
90 K=38-(JU3-JU2): LL=0
*
*
* Perform calculations for crop over the update period. LL is date counter.
*  Forecast day is K=39.
*
*
100 FOR L=K TO 39
* Plant check.
110 JU=JU2+LL: IF JU<JP THEN 410
120 IF JU=JP THEN E1=E(L)
* Forecast check.
130 IF L=39 THEN E(L)=E(L-1)+F1
* Interpolate crop consumptive use data to find sum et to-date (A).
*  The et adjustment (ETA) is also applied. Also check for terminate.
140 G1=(E(L)-E1)/5: G1=INT(G1)+1: G2=G1+1: IF G2>11 OR G0(ID,G2)=0 THEN 430
150 A=G0(ID,G1)+(((E(L)-E1-E0(G1))/5))*(G0(ID,G2)-G0(ID,G1)): A=A*ETA(ID)
* Update days, set ET=A.
160 IF L<=38 THEN ET=A: GO 180
* Forecast day, calculate forecast et=FET.
170 FET=(A-ET)/7: GO 430
* Calculate allowable depletion (AL).
180 G=FA(ID)*HC: AL=(.33*G)+(G*((JU-JP)/60)): IF AL>G THEN AL=G
* If factor = 0, allowable depletion is preset as holding capacity.
190 IF FA(ID)=0 THEN AL=HC
* Calculate adjusted sum et to-date (G7), which is the sum et to-date.
200 G7=ET-(AL+ER(L)): IF G7>0 THEN 240
* Adjusted sum et is before plant, so find interval (IV) and irr. requirement.
210 IV=JU-JP: IF IV<=0 THEN IV=1
220 IR=((ET-ER(L))/IV)+.005: IR=(INT(IR*100)/100): IF IR<0 THEN IR=0
230 GO 380
* Adjusted sum et is after plant, so search crop consumptive use data for
```

```
240 FOR I=1 TO 11
250 IF G7<G0(ID,I) THEN 270
260 NEXT I
270 J=I-1:E7=(E0[J]+((G7-G0[ID,J])/(G0[ID,I]-G0[ID,J])*5))+E1
* Search climate data sum etp for etp day. Search is thru past 38 days.
280 FOR J=1 TO 38
290 IF E7<E(J) THEN 310
300 NEXT J
* Find interval IV.
310 IV=L-J:IF J=1 THEN 340
* Etp is within 38 days. Find interval V, which is used for irr. requirement
*  calculation = IR = allowable/interval.
320 X=(E7-E(J-1))/(E(J)-E(J-1)):V=IV+1-X:IF X<=.5 THEN IV=IV+1
330 IR=AL/V:GO 370
* Etp is beyond 38 days. Interpolate crop consumptive use data to find sum et
*  from plant to first update day (A). Then calculate adjusted sum et (G7)
*  and use to calculate irr. requirement (IR).
340 G1=(E(J)-E1)/5:G1=INT(G1)+1:G2=G1+1
350 A=G0(ID,G1)+(((E(J)-E1-E0(G1))/5))*(G0(ID,G2)-G0(ID,G1))
360 G7=((ET-A)*ETA(ID))-ER(L):IR=G7/IV
* If not first day of update and there is an effective rain, todays irr.
*  requirement is limited to todays et.
370 IF L=K OR ER(L)=0 THEN 390
380 IF IR>(ET-PET) THEN IR=ET-PET
* Store todays et as PET, and round the irr. requirement.
390 PET=ET:IR=(INT((IR+.005)*100))/100
* Total the irr. requirement = IRS. Calculate the total irr. requirement
* in ac-ft = TIR.
400 IRS=IRS+IR:TIR=TIR+(INT((((IR*AC)/12)+.05)*10)/10)
* Increment date counter.
410 LL=LL+1
420 NEXT L
*
*
* End of calculations for crop.
*
*
* Print area, system, and crop names on CRT, and write updated crop data
```

```
* onto temporary updated area file (INTER2).
*
430 PRINT A$;S$;C$
440 PRINT#2;A$;S$;C$;TAB 36;AC;TAB 42;ID;TAB 45;JP;TAB 50;E1;TAB 55;BA;
450 PRINT#2;TAB 60;EF;TAB 64;HC;TAB 69;IRS;TAB 74;T_R
*
* Increment N counter.
*
460 N=N+1
*
* Find seasonal et index (I) from the crop consumptive use data.
*
470 FOR I=11 TO 1 STEP-1
480 IF G0(ID,I)>0 THEN 500
490 NEXT I
*
* Before plant check.
*
500 IF G2=0 THEN 540
*
* If terminated, ET = consumptive use to-date.
*
510 IF G2>11 OR G0(ID,G2)=0 THEN AL=0:ET=G0(ID,I)*ETA(ID)
*
* Find next interval (N2), based on allowable and forecast et.
*
520 IF FET=0 THEN 540
530 N1=AL/FET:N2=INT(N1):N3=N1-N2:IF N3>=.5 THEN N2=N2+1
*
* Write results onto intermediate file (INTER) for use in printout programs
*  PDIST and PGUID.
*
540 PRINT#3;S$;C$;AC;JP;EF;BA*AC;
* Calculate and write seasonal consumptive use in ac-ft.
550 PRINT#3;INT(((G0(ID,I)*ETA(ID)*AC/12)+.05)*10)/10;
* Calculate and write consumptive use to-date in ac-ft, etc.
560 PRINT#3;INT(((ET*AC/12)+.05)*10)/10;TIR;AL;IR;INT((FET+.005)*100)/100;IV;N2
*
```

```
* Loop for next crop.
*
570 GO 40
*
* End of a system (999 encountered on area file). Write 999 onto temporary
*  updated area and intermediate files. Loop for next system.
*
580 PRINT#2;A$
590 PRINT#3;A$
600 GO 30
*
* Close area and temporary updated area files, and compile remainder of
*  program (PCALDR2).
*
610 END#1
620 END#2
630 END#3
640 GET "PCALDR2"
GO
```

```
$
$ Program PCALDR2 copies the new temporary area file (INTER2) produced in
$   program PCALDR1 back to the area file (AREA).
$
10 DIM B$(90)
*
* Open the area file (AREA) and the temporary updated area file (INTER2).
*
20 OPEN#1,"AREA/TXT:DR0"
30 OPEN#2,"INTER2/TXT:DR0"
*
* Copy temporary updated area file (INTER2) back to area file (AREA).
*
40 INPUT#2,B$
50 IF EOF#2 THEN 80
60 PRINT#1,B$
70 GO 40
*
* Close the area file and return control to Disk Operating System.
*
80 END#1
90 DOS
GO
```

```
$
$ Program PDIST uses the data located on the intermediate file (INTER),
$  which was produced in program PCALDR1, and the select district file
$  (SELDIST) to generate irrigation district delivery schedules. These
$  schedules are produced on the PRINTER.
$
10 DIM A$[16],A1$[16],S1$[8],S$[8],C$[10],DI[7],LF$[1],PG$[1],Y(13),Z$(16)
*
* Month end julian calendar dates are defined.
*
20 READ Y(1),Y(2),Y(3),Y(4),Y(5),Y(6),Y(7),Y(8),Y(9),Y(10),Y(11),Y(12),Y(13)
30 DATA 0,31,59,90,120,151,181,212,243,273,304,334,365
*
* Open intermediate file (INTER) and initalize print variables.
*
40 OPEN#1,"INTER/TXT:DR0"
50 A1$="    ";LF$[1]=10:PG$[1]=12:Q=4
*
* Read todays date and julian date from intermediate file.
*
60 INPUT#1,D,JU3
*
* Open select district file (SELDIST).
*
70 OPEN#2,"SELDIST/TXT:DR0"
*
* Read the selected area name from the select district file.
*
80 INPUT#2,Z$
90 IF EOF#2 THEN 630
*
* Read area name from the intermediate file, and check against selected area.
*
100 INPUT#1,A$
110 IF EOF#1 THEN 590
120 IF A$<>Z$ THEN 100
*
```

```
* If new area, print headings on PRINTER.
*
130 IF A$=A1$ THEN 260
140 PRINT#0;PG$
150 PRINT#0;TAB 20;"IRRIGATION DISTRICT DELIVERY SCHEDULE";TAB 70;"DATE: ";
160 PRINT#0;D;LF$
170 PRINT#0;TAB 10;"LOCATION:  ";A$;TAB 60;
180 PRINT#0;"NOTE:  ALL DATA IN ACRE FEET";LF$
190 PRINT#0;TAB 62;"$$$$$$$$$$$$$$$$$$$$$$ DELIVERY REQUIREMENT ";
200 PRINT#0;"$$$$$$$$$$$$$$$$$$$$$$"
210 PRINT#0;TAB 24;"BASE";TAB 36;"CU";TAB 45;"CU";TAB 51;"DIVERSIONS";
220 PRINT#0;TAB 79;"------------------ FORECAST ------------------"
230 PRINT#0;"  SYSTEM    ACRES   ALLOCATION  SEASONAL  TO-DATE   TO-DATE";
240 PRINT#0;"   TO-DATE   TODAY  DAY 1  DAY 2  DAY 3  DAY 4  DAY 5  DAY 6";
250 PRINT#0;"  DAY 7";LF$
*
* Initalize variables.
*
260 FOR I=1 TO 7
270 DI[I]=0
280 NEXT I
290 ACT=BAT=SETT=TCUT=I0=I7=TIRT=IR0=0
*
*
* Read crop data from intermediate file, and process data.
*
*
300 INPUT#1,S$,C$,AC,JP,EF,BC,SET,TCU,TIR,X,IR,FET
310 IF S$="999" THEN 500
* Store system name for printing.
320 S1$=S$
* Find decimal equivalent of efficiency.
330 EF=EF/100
* Sum the acres, base allocations, seasonal consumptive use, consumptive use
*  to-date, and irr. requirement to-date.
340 ACT=ACT+AC
350 BAT=BAT+BC
360 SETT=SETT+SET
```

```
370 TCUT=TCUT+TCU
380 TIRT=TIRT+(TIR/EF)
*
* Calculate forecast delivery requirements if planted.
*
390 IF JP>JU3 THEN 300
* I0 = todays irr. requirement. I7 = irr. requirement on 7th forecast day.
400 I0=(IR+AC/EF)/12
410 I7=(FET+AC/EF)/12
* D0 = average for each of 7 days.
420 D0=(I7-I0)/7
* For each forecast day, find sum of irr. requirements to-date = B.
430 FOR I=1 TO 7
440 B=I0+(D0*I)
* Check if terminated.
450 IF (TCU+B)>SET THEN 480
* Sum the irr. requirements for each forecast day.
460 DI(I)=DI(I)+B
470 NEXT I
* Sum the irr. requirements for today.
480 IR0=IR0+I0
*
*
* Loop for next crop.
*
*
490 GO 300
*
* System is finished.
*
* Round the irr. requirements for today and each of the forecast 7 days.
*
500 IR0=(INT((IR0+.05)*10)/10)
510 FOR I=1 TO 7
520 DI(I)=(INT((DI(I)+.05)*10)/10)
530 NEXT I
*
* Print the results for the system on the PRINTER.
```

```
*
540 PRINT#0;TAB 2;S1$;TAB 11;ACT;TAB 20;BAT;TAB 31;SETT;TAB 41;TCUT;
550 PRINT#0;TAB 61;TIRT;TAB 71;IR0;TAB 78;DI[1];TAB 85;DI[2];TAB 92;DI[3];
560 PRINT#0;TAB 99;DI[4];TAB 106;DI[5];TAB 113;DI[6];TAB 120;DI[7]
*
* Define area name in A1$ array.
*
570 A1$=A$
*
* Loop for new system.
*
580 GO 100
*
* End of an area. Close and reopen the intermediate file. Loop for a new area.
*
590 END#1
600 OPEN#1,"INTER/TXT:DR0"
610 INPUT#1,X
620 GO 80
*
* Return control to Disk Operating System.
*
630 DOS
GO
```

```
$
$ Program PGUID uses the data located on the intermediate file (INTER),
$  which was produced in program PCALDR1, and the select guide file
$  (SELGUID) to generate irrigation guides. These guides are produced
$  on the PRINTER.
$
10 DIM A$[16],A1$[16],S$[8],C$[10],Y[13],LF$[1],FG$[1],DA[6],DAY[6],Z$[16]
*
* Month end julian calendar dates are defined.
*
20 READ Y[1],Y[2],Y[3],Y[4],Y[5],Y[6],Y[7],Y[8],Y[9],Y[10],Y[11],Y[12],Y[13]
30 DATA 0,31,59,90,120,151,181,212,243,273,304,334,365
*
* Initalize print variables.
*
40 A1$="     ";LF$[1]=10;FG$[1]=12;Q=4
*
* Open intermediate file (INTER).
*
50 OPEN#1,"INTER/TXT:DR0"
*
* Read todays date and julian date from intermediate file.
*
60 INPUT#1,D,JU3
*
* Initalize L, and define dates for 'date of last irrigation' heading
*  on guide printout.
*
70 L=6
80 FOR I=2 TO 12 STEP 2
90 JU=JU3-I
100 FOR K=1 TO 13
110 IF JU<=Y[K] THEN 130
120 NEXT K
130 K=K-1;DA[L]=(K*100)+(JU-Y[K])
140 L=L-1
150 NEXT I
```

```
*
* Open select guide (SELGUID) file.
*
160 OPEN#2,"SELGUID/TXT:DR0"
*
* Read the selected area name from the select guide file.
*
170 INPUT#2,Z$
180 IF EOF#2 THEN 670
*
* Read area name from the intermediate file, and check against selected area.
*
190 INPUT#1,A$
200 IF EOF#1 THEN 670
210 IF A$<>Z$ THEN 190
*
* If new area, print headings on PRINTER.
*
220 IF A$=A1$ THEN 330
230 PRINT#Q;PG$
240 PRINT#Q;TAB 5;"FARM IRRIGATION GUIDE CONTAINING NEXT IRRIGATION DATES";
250 PRINT#Q;TAB 65;"DATE:   ";D;LF$
260 PRINT#Q;TAB 10;A$;LF$
270 PRINT#Q;TAB 32;"------- DATE OF LAST IRRIGATION -------"
280 PRINT#Q;TAB 31;DA[1];TAB 38;DA[2];TAB 45;DA[3];TAB 52;DA[4];
290 PRINT#Q;TAB 59;DA[5];TAB 66;DA[6]
300 PRINT#Q;TAB 11;"PLANT ALLOW";TAB 75;"INTERVAL"
310 PRINT#Q;"  CROP      DATE  DEPL.  ET";TAB 74;"LAST  NEXT"
320 PRINT#Q;"---------- ----  ---   -----";TAB 74;"----  ----"
*
* Initalize variables.
*
330 FOR I=1 TO 6
340 DAY[I]=0
350 NEXT I
*
*
* Read crop data from intermediate file, and process data.
```

```
*
*
360 INPUT#1, S$, C$, AC, JP, X, X, SET, TCU, X, AL, IR, FET, LAS, NEX
370 IF S$="999" THEN 650
*
* Check if planted, if forecast et is zero, or if terminated.
*
380 IF JP>JU3 THEN 560
390 IF FET=0 THEN 560
400 IF TCU>=SET THEN 560
*
* For each of 6 dates of last irrigation, find next irrigation dates for
*  the crop.
*
410 FOR I=1 TO 6
420 N=I-1
* Plant check calculation, at last irrigation.
430 JUB=JU3-12+(2*N)
440 IF JP>JUB THEN 550
* Calculate irr. requirement at last irrigation.
450 IRB=(12-(2*N))*IR
* Calculate remainder of irr. requirement (at end of update period),
*  using allowable depletion and irr. requirement at last irrigation.
460 RE=AL-IRB
* Calculate number of days from end of update period to next irrigation (N2).
470 N1=RE/FET
480 IF RE<=0 THEN N1=RE/IR
490 N2=INT(N1): N3=N1-N2: IF N3>=.5 THEN N2=N2+1
* Add number of days (N2) to todays julian date.
500 JU=JU3+N2
* Find month-day of next irrigation.
510 FOR K=1 TO 13
520 IF JU<=Y[K] THEN 540
530 NEXT K
540 K=K-1: DAY[I]=(K*100)+(JU-Y[K])
550 NEXT I
* Find month-day equivalent of plant date (PD).
560 FOR K=1 TO 13
```

```
570 IF JP<=Y[K] THEN 590
580 NEXT K
590 K=K-1:PD=(K*100)+(JP-Y[K])
*
* Print the results for the crop on the PRINTER.
*
600 PRINT#0;C$;PD;TAB 16;INT((AL+.05)*10)/10;TAB 22;FET;TAB 31;DAY[1];
610 PRINT#0;TAB 38;DAY[2];
620 PRINT#0;TAB 45;DAY[3];TAB 52;DAY[4];TAB 59;DAY[5];TAB 66;DAY[6];
630 PRINT#0;TAB 74;LAS;TAB 80;NEX
*
*
* Loop for next crop.
*
*
640 GO 330
*
* End of an area. Define area names in A1$ array, and loop for next area.
*
650 A1$=A$
660 GO 170
*
* Return control to Disk Operating System.
*
670 DOS
GO
```


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